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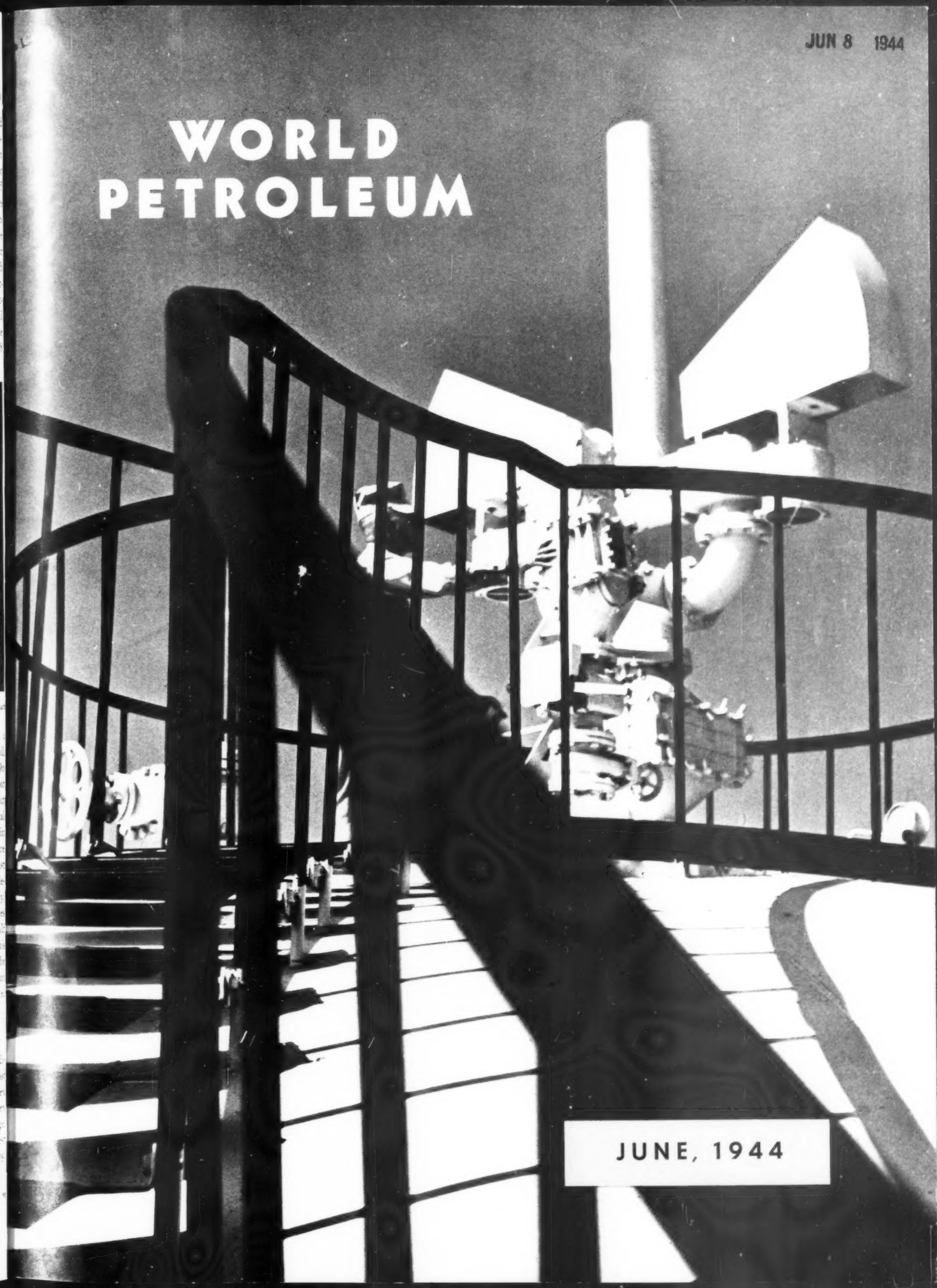

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INCORPORATING PETROLEUM EQUIPMENT EXPORTER

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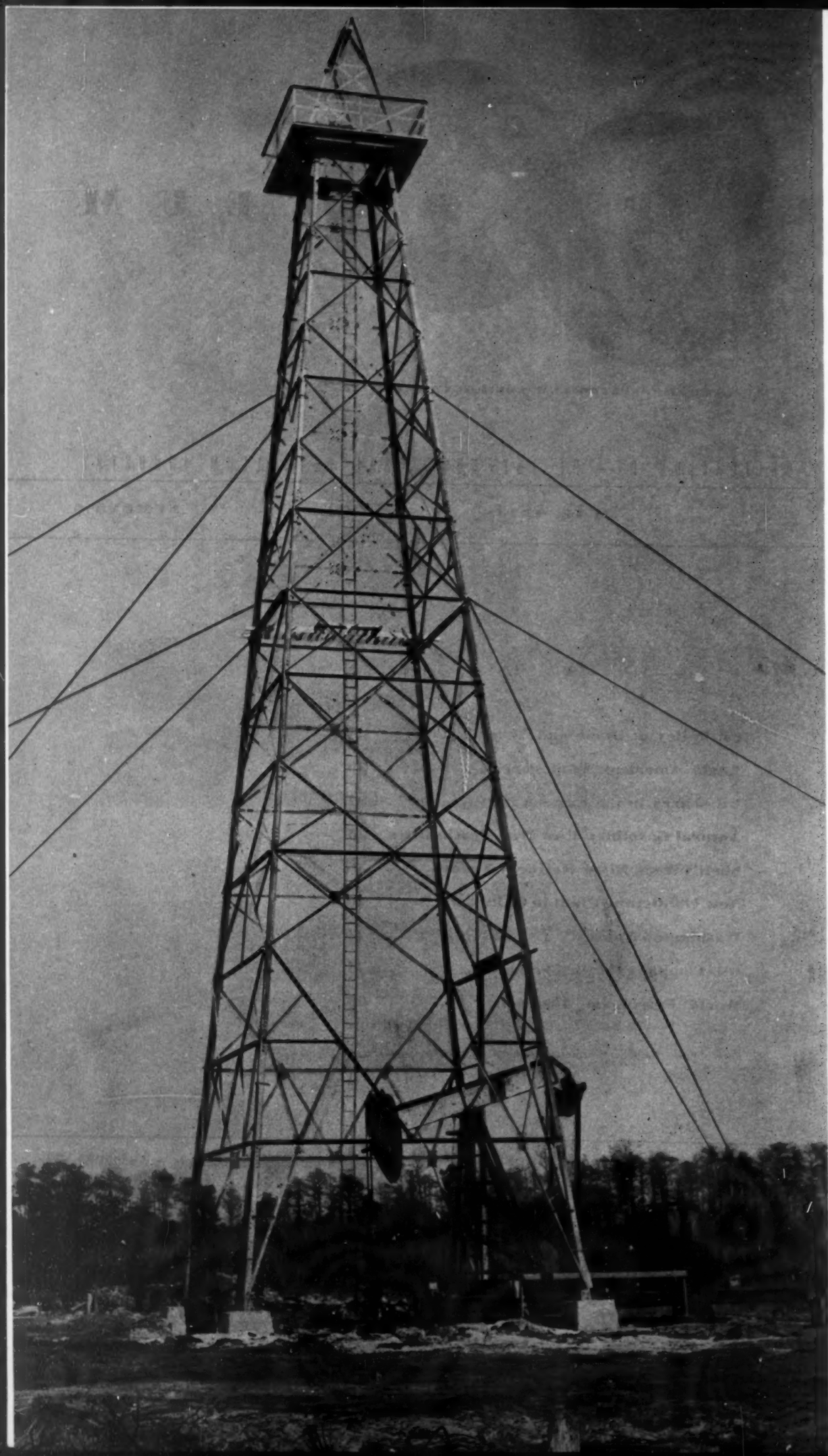
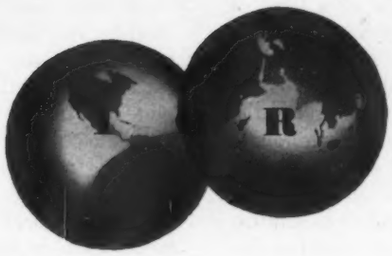


Florida Discovery Well of Humble Oil Company, Sunniland.

Miami Herald Photo.

EDITORIAL



OIL POLICY AT HOME AND ABROAD

IN the process of working out a world policy and international machinery for its implementation the United States faces one difficulty that need not disturb other countries whose participation in the plan is essential if it is to be of any practical effect. That is the complete divergence between the attitude of the government toward the domestic activities of the oil industry and the position which it necessarily must assume toward similar operations beyond its own borders.

While the precise scope of the projected convention to regulate international trade in petroleum products, in the establishment of which the government of the United States has taken the initiative, has not been defined its general objectives have been stated rather clearly. These purposes, aside from any political aims that may be involved, are to encourage the orderly production of oil wherever it may be found to exist, to prevent wasteful practices in its production and distribution, to make petroleum products available to all nations in accordance with their needs (thereby giving effect to one of the clauses included in the Atlantic Charter) and in general to maintain a balance between supply and demand to the end that this most useful of the world's natural resources may be effectively conserved and utilized in the most advantageous manner.

Whether these plans are to be put into effect through purely governmental agencies or by private companies operating under the supervision of the governments participating in the undertaking it is obvious that a closer degree of control than has existed heretofore, except of course in those countries where absolute monopolies have existed, will be required. In the past by far the greater part of the world's oil output has been consumed by a few highly industrialized nations, but if the needs of less progressive countries and the desirability of encouraging their development and raising the living standards of their populations are to become factors governing distribution new methods for directing trade operations and governing the flow of oil products to assigned destinations must be established. Even if the proposed convention is confined to the less difficult goal of eliminating wasteful price wars on the one hand and preventing combinations to limit supplies and exact exorbitant rates on the other, it will involve the exercise of authority to dictate supplies and establish market allotments. In other words the accomplishment of the avowed intentions animating the projected regulation of the international movement of oil involves the setting up of a world-wide cartel.

Now this word cartel has poisonous implications to American ears. Politically it is the TNT of the unabridged dictionary of condemnatory appellations. The mere accusation that an agreement to limit production, divide markets or otherwise modify the competitive struggle exists among companies or individuals is sufficient to create powerful prejudice against the concerns toward whom the charge is leveled. Proof of such an understanding subjects them to extreme criminal and civil penalties under the laws of the land. Elsewhere no such intense feeling on this subject seems to prevail. In most other countries trade agreements are not merely lawful but are looked upon as useful commercial devices even when they extend to market sharing and price maintenance. In some countries participation in such agreements has been made compulsory, just as it is now compulsory in the United States under certain circumstances for a workingman to join a union and to pay such dues as the union may exact in order to hold a job. In some official quarters to be sure it is held that agreements to control trade are objectionable only if they exist among private companies but become praiseworthy when made between governments, though even there seems to be a preference for describing them by a term less approbrious than cartel.

In the domestic field, however, both law and custom prescribe the fullest range of competition and this system has prevailed throughout all lines of industry until within the past dozen years when the federal government itself has extended its authority over certain forms of agricultural activity with the avowed object of restricting production and promoting scarcity. Although there is a well-designed purpose to establish this as a permanent feature of the nation's economy it cannot yet be regarded as a settled part of American policy. Aside from this exception the laws against restraint of trade, insofar as oil is concerned, have been carried beyond their original intention and have been given such a strained interpretation that they prevent any form of unified action by firms and individuals engaged in a common pursuit or even the discussion of constructive measures that are more beneficial to the public than to the particular business to which it is proposed to apply them.

For reasons of assumed political advantage the oil industry has been made the target of special attack under the guise of anti-trust law enforcement. In the celebrated Madison case oil companies and their officials were prosecuted and fined for coming to the rescue of small

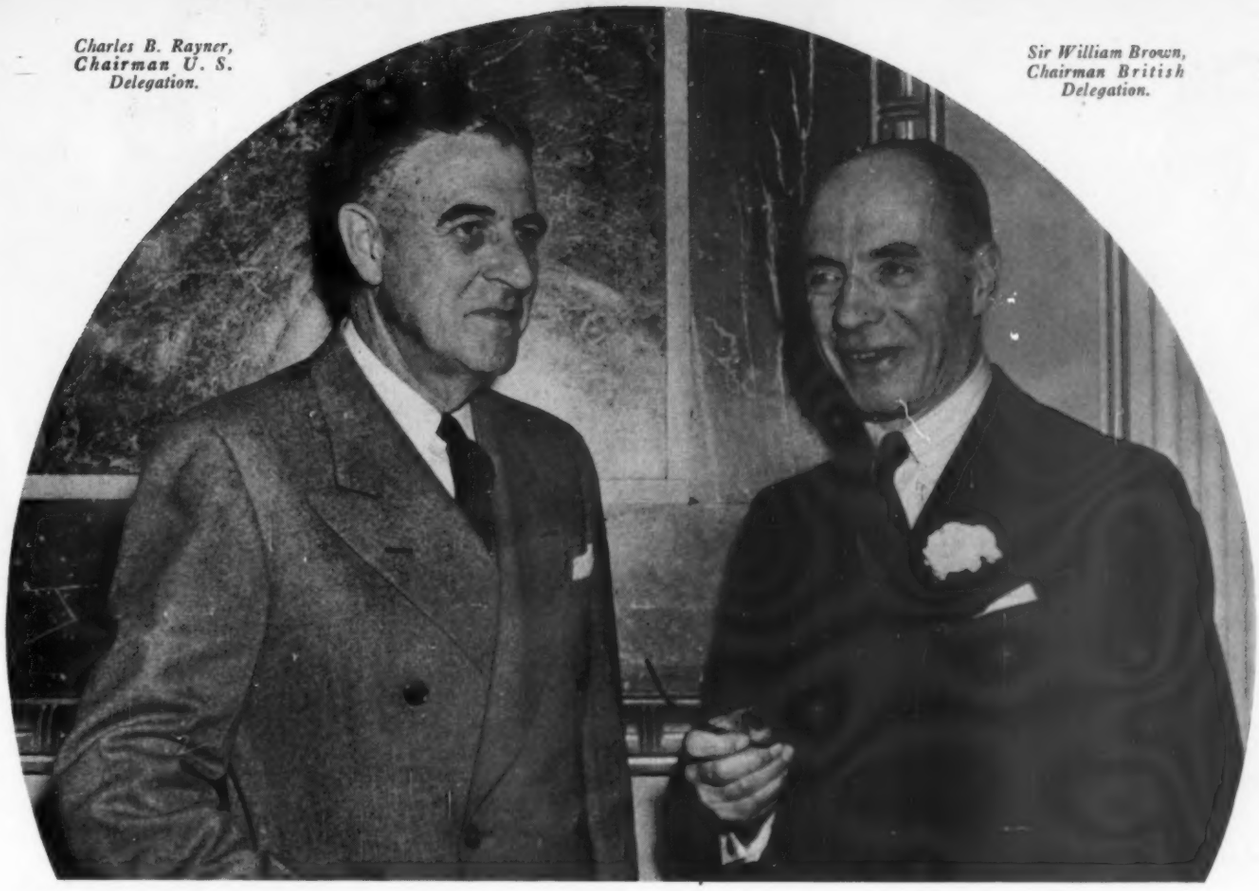
producers and purchasing distressed crude at a time of extreme oversupply, a procedure that had been initiated and urged upon the companies by the government itself. No practice can be more wasteful of the nation's oil resources than the production of oil for which no outlet can be found and the resultant establishment of ruinously low prices. This "victory", however, did not satisfy the zealots of the Department of Justice who proceeded to formulate a case against the most prominent of the industry's numerous trade associations, an organization devoted primarily to the promotion of technical progress, safety measures, the establishment of uniform standards of equipment and operation, the avoidance of waste and the encouragement of practices promoting conservation. This attempt at the dismemberment of the industry was halted only by the intervention of the war and is still scheduled for renewal as soon as the present emergency has ended.

An example of the extent to which the disruptive influence of the federal administration has been carried was provided recently when the Petroleum Industry War Council set up a sub-committee to assemble factual information as to post-war conditions affecting its operations. This was at a time when industry generally was being urged to engage in post-war planning in order to reduce as much as possible the shock of transition from a wartime to a peacetime economy. The committee members were warned by their legal advisers, however, that any descission of post-war supplies and probable demand or of action to meet future conditions might subject them to prosecution under the position taken by the Justice Department and the committee was liquidated.

The only point in referring to this situation is to direct attention to the fact which Mr. George Hill Jr. has brought out strikingly in a recent address that oil policy at home and oil policy abroad are entirely unrelated and subject to quite separate controls. The former is determined by laws which change only as they are subjected to judicial determination; the latter is subject only to the federal administration which happens to be in power, which means in effect that it represents the will of the President. The foreign oil policy of the government, therefore, may be either definite, vigorous and constructive or it may be weak, vacillating and ambiguous according to the character of the Chief Executive or the degree of his interest in maintaining the nation's position in this field.

If, however, the United States is to participate in an international agreement designed to bring about the practice of conservation in the production of oil in other parts of the world, the orderly distribution of products in accordance with the needs of consuming nations and the virtual balancing of supply and demand—if equality of opportunity is to be a guiding principle—a revision of its attitude toward the domestic industry is clearly desirable and indeed necessary. A view that seems to prevail in some official circles in Washington is that no such reconciliation will be needed because the United States will cease to be an exporter after the war and will on the contrary become a large importer on balance. There is no ground for such an assumption unless this condition is forced upon the country by the government itself. It is probable that imports will rise to a volume larger than in the pre-war period because there will be an increased demand for certain kinds of crude most readily obtainable from other countries, specifically from the Caribbean area, but the United States perforce must continue to export products in the immediate future as in the past for the obvious reason that it possesses manufacturing facilities which do not exist elsewhere in extent sufficient to meet world requirements. Moreover, when the extraordinary demands arising from the war come to an end, if the American oil industry is permitted to resume its normal development, this country's production will be sufficient to supply domestic needs and in addition to resume its former position as an exporter of petroleum products. It would be manifestly unfair to some millions of American citizens whose livelihood is dependent upon the oil industry to discriminate against them in order to confer special advantages upon the peoples of other lands who have shown no similar ability or disposition to develop their own resources.

The American oil industry never has asked and will not seek anything more than a fair opportunity at home and abroad to exercise its own energy and initiative on equal terms with men of other nations. There is no sympathy within the industry for price agreements or any form of cartel. The industry is as highly competitive as any other in the country and its members agree that this free competition in quality, service and price has been responsible for the remarkable progress it has made and for putting its products into universal use at a lower cost than prevails in almost any other part of the world. The industry asks and is entitled to receive relief from discriminatory treatment and proscriptive action on the part of its own government. It should be encouraged to act collectively for the adoption of measures of conservation, for the avoidance of unnecessary wastes in production and distribution and the development of improved technical processes and new uses for the more complete utilization of the materials with which it deals. These are after all the most effective means of conservation that have ever been devised. To establish full freedom of opportunity for the industry to serve the nation to the greatest advantage both at home and abroad actually calls for nothing more than a revision of the hostile attitude which the federal administration has displayed toward it but if legislation is needed to bring that about then the laws should be changed.



Charles B. Rayner, Chairman U. S. Delegation.

Sir William Brown, Chairman British Delegation.

ANGLO-AMERICAN CONFERENCE PAVES WAY FOR FUTURE AGREEMENT

Frank Discussion Carried on at Exploratory Session in Washington Is Held to Presage Full Understanding Between Britain and United States as Preliminary to International Convention.

APPARENTLY Great Britain and the United States are nearer to an accord on the matter of postwar international oil problems than was expected in official circles when the technical expert delegates of the two countries gathered round the conference table in Washington April 18. Amity seemed to pervade the sessions which broke up May 3 to permit the members to report back their findings to their respective governments and pave the way for the meeting of the "higher level" groups who will carry the projected understanding through to the stage of final consideration by the heads of the two governments.

Secretary of State Hull let it be known that he was well pleased with the proceedings and said the work of the delegates had been excellent and augured well for the final outcome of the negotiations. In announcing the close of the "preliminary exploratory discussions", the State Department said:

"In a spirit of understanding and cooperation, the two groups explored the full range of both countries' interest in petroleum on the basis of broad principles looking to the orderly long-range development of abundant oil supplies. The two groups are now reporting the results of these discussions to their governments.

"After the full discussion of broad principles, the two groups reviewed various specific matters of mutual interest relating to the production, distribution and transportation of oil. These specific matters included pending problems affecting the oil operations abroad of the American and British oil industry, questions relating to oil production, particularly in the Middle East, the proposed trans-Arabian pipeline and the Iraq Petroleum Company's project for an additional pipeline from Kirkuk, Iraq, to Haifa. The groups shared the view that the peace-time intergovernmental aspects of such matters should be resolved, as between the two governments, within the framework of the broad principles which had been discussed".

Although little of a definite nature has been allowed to leak out concerning the proceedings, it is well understood that "principles" were the chief concern of the delegates rather than machinery for regulating post-war international oil trade. Among these were agreement on the necessity for equal opportunity for the interests of the two nations in developing world oil resources, free access to these resources by consuming countries, conservation of reserves and orderly marketing.

Despite persistent rumors to the contrary, it is pretty well established that the outlawing of cartels between foreign oil companies, restricting operations of American companies abroad, did not come up for discussion. On the other hand, it was made plain that expanding and not contracting markets—hence cartels—were the concern of the delegates.

Part of the success of the conference is attributed to the manner in which it was conducted. The atmosphere was that of a round table discussion with the chairmen of the two delegations acting as interlocutors and the other members contributing information or answering questions relating to the special phases of the international situation with which they were familiar. The result was a free give and take much more favorable to the understanding of relative viewpoints than would have been the case with more formal exchanges. Thus the conference was in a true sense exploratory and paved the way for a clear understanding of the position of the two groups that will enable participants in the next meeting

American and British Oil Experts Who Met for the First Time on April 18th at the State Department. Left to Right: Sir William Brown, Charles B. Rayner, Sir William Fraser, J. H. Le Rougetel, Ralph K. Davies, F. C. Starling, Col. H. Blake-Tyler, Harold Wilkinson, William Hoyter, Sir Frederick Godber, F. Harmer, Commodore A. W. Clarke, Victor Butler, Paul Alling, Leroy Stinebower, Commodore A. F. Carter, Brig. Gen. H. L. Peckam, C. S. Snodgrass, John Loftus, George Walden, James C. Sappington III.

to define in advance their position on the various points discussed and thereby result in considerable time saving.

In response to vigorous protests from the American oil industry plans for the conference were changed at the last minute to give the industry a form of representation in the proceedings. Ten officials of American oil companies were invited to present their views, when, as and if called on by the United States delegates, who were representatives of the Departments of State, War and Navy and the Petroleum Administration for War. At first, however, it was not intended that these oil men sit in the conference room or take part in the discussions. But a further concession was made by allowing three of the industry men to attend the discussions as advisors to the American group. These were John A. Brown of Socony-Vacuum, W. S. S. Rodgers of Texas Company, and A. Jacobsen of Amerada Petroleum.

The report of the United States delegates is now before the Cabinet Committee, or "higher level" group, appointed by the President March 7 for that purpose and headed by Secretary Hull. In addition to the chief of the State Department this committee consists of Secretary of Interior Ickes as vice chairman, Secretary of Navy Forrestal, Under Secretary of War Patterson, War Production Board Vice Chairman Charles E. Wilson, the Secretary of State's Petroleum Advisor, Charles Rayner, Director of the Foreign Economic Administration Leo Crowley, and Deputy Petroleum Administrator Ralph K. Davies. Mr. Crowley, who is also chairman of the board of Petroleum Reserves Corporation, and Mr. Davies were not originally named as members but were added at the conclusion of the "exploratory" discussions.

Thus far the British have not named their "higher level" delegates, although the President named the United States delegates back early in March. Indications are that the conferences of these groups will not be held till sometime in June. The place of the meeting has not been announced but the general assumption in Washington is that it will be held there.

Sometime ago it was stated that at the meeting subsequent to the one held last month representatives of other countries having important interests in oil would be invited to attend. Russia, the Netherlands and Venezuela were mentioned specifically as three of the countries to be included. It is possible that this plan may still be followed but since the preliminary conference dealt mainly with matters affecting Britain and the United States it is considered possible that it may be deemed advisable first to arrive at a full understanding on these questions and to outline a body of principles on which the two nations can stand together before summoning a general conference to formulate an international oil convention. It is considered logical that the two countries having the broadest interest in oil, both as producers and consumers, should take the lead in this matter since their position and views might be expected to carry much weight in shaping any plan that may be finally adopted. Russia, of course, is recognized as a great oil power with potential production and reserves perhaps larger than any other one country. In the years immediately preceding the war, however, Russian exports had shrunk to relatively small proportions as the Soviet supply was almost completely absorbed in carrying on the country's great program of industrialization. In view of the vast task of reconstruction needed to repair the destruction caused by the Nazi invasion and the heavy demands for motorized equipment and fuel to set the national machinery of production in full motion again it is assumed that domestic requirements will continue to absorb the Soviet oil supply for some years to come. Nevertheless Russia's place in the international oil picture is certain to be recognized in working out any program of international cooperation and Russia's acquiesence in any plan that may be finally agreed upon is looked upon as essential to its success.

In the discussion that has been stimulated by the holding of the recent conference opinion leans strongly to the view that any attempt by an international authority to dictate the internal policies of any country in relation to its oil industry or to regulate the amount of its production would be doomed to failure. It is held, however, that educational or advisory influences can be exerted through a bureau that would point out the advantages of conservation and of holding production to rates that will result in long life and maximum recovery from developed fields. Such a bureau, functioning somewhat along the lines followed by the Bureau of Mines of the United States, is looked upon as a probable feature of any international convention that may be established. If agreement can be reached upon a quota system or some similar plan for guiding distribution, it is pointed out there will be no reason for attempting to impose any restriction upon the domestic policies of any country.

So confident are those in informed circles in Washington that some definite international agreement relating to oil will result ultimately from the negotiations that have been initiated that nominations for the important post of director of the proposed international conference are being put forward. Among the names mentioned in this connection are those of Petroleum Administrator Ickes, former Secretary of War Patrick J. Hurley who has represented the President on various international missions relating to oil, and Walter C. Teagle, former chairman of Standard Oil Company (N. J.). This is merely the ordinary Washington slant on such matters and discussion of personalities at this stage of proceedings is admittedly premature.

OIL SEARCH IN THE EASTERN GULF REGION

By Joseph A. Kornfeld
Consulting Geologist

While the southeastern area of the United States, embracing the region extending along the Gulf Coast from the Mississippi River eastward, has received considerable attention from geological and geophysical crews for the past several years interest in this section has been greatly stimulated by recent discoveries in Florida, Mississippi and Alabama. None of these proves the existence of fields of major rank but they do demonstrate the presence of oil and suggest important potentialities. The prospect of developing new reserves along an extensive belt in the eastern gulf region appeals to the imagination. Leasing and survey activities are being greatly extended and current developments indicate that a long range program of exploration is under way. Progress to date in this region and findings which are held to justify intensified search are described in the accompanying article.

DISCOVERY of oil production in the heart of the Everglades in the southern part of the Florida peninsula in November of 1943 has given the greatest impetus to exploration, leasing and drilling in the southeastern states since the discovery of the Tinsley field in western Mississippi four years ago.* The Sunniland pool, uncovered in the Big Cypress Swamp in Collier county, not only set a producing depth record of 11,625 feet for the eastern gulf region but opened up a new sub-province of millions of acres to geological and geophysical exploration.

Nearly 600 miles (air-line distance) separates this discovery from the nearest other producing area, the new Gilbertown field of Choctaw county, Alabama, in itself the first oil pool in that state.

Across the intervening crescent in the coastward counties of Alabama, Georgia and western Florida, geophysical crews are being employed in a large scale search for local structures. The most popular geophysical method used is the gravity meter, although the reflection seismograph and the magnetometer are still playing an important part in the exploration work in that region. Anomalies found by these geophysical methods are being continually verified by the core-drill before attempting to prove an area by the drill.

Success at Sunniland has revived deep drilling in the Everglades where several geophysical structures are being tested by the drill at the time of this writing. The Ocala uplift of northern Florida is due for drilling exploration this year. Regional significance of the discovery lies in its proving productive the lower Cretaceous wedge which attains a thickness of more than 2,000 feet at Sunniland, being overlapped northward towards the Ocala uplift.

Economic factors influencing the exploration program in the southeastern states are favored by the presence of vast areas unexplored by geophysical instruments, proximity to tidewater, low lease bonus prices, and low-rentals of acreage acquisitions.

More than 1,600,000 acres are now under lease in the Eastern Gulf province. Of this total, approximately 8,000,000 acres represents the leasing status in Florida, 5,500,000 acres covers present leaseholds in Mississippi, 2,000,000 acres is the Alabama total, while 500,000 acres have been signed up in Georgia.

Against these figures there is an annual cancellation in excess of 2,000,000 acres (during 1942) representing leaseholds dropped because of exploratory dry holes, lease expirations, new geophysical and geologic data, change in company policies, and the like.

*World Petroleum, March, 1940.

Humble Oil and Refining Company is by far the largest leaseowner in Florida, the company's total holdings in that state exceeding 2,000,000 acres, principally in the central southern and southern portions. Pure Oil Company has more than 850,000 acres principally in the north-central (Ocala uplift) and northwestern portions. Sun Oil Company's lease investment in the state covers 700,000 acres, while Gulf Oil Corporation holds nearly 550,000 acres. Sinclair Prairie Oil Company is represented with approximately 100,000 acres. Sunray Oil Company has extensive holdings around the Ocala uplift.

Of the more than 2,000,000 acres under lease in Alabama, 21 companies own nearly 90 per cent. Humble is the most active organization, with more than 850,000 acres. Under lease to Magnolia Petroleum Company (Socony-Vacuum) are approximately 250,000 acres. Superior Oil Company has 200,000 acres, Atlantic Refining Company 190,000, Sinclair Prairie Oil Company 100,000 acres, Stanolind Oil and Gas Company 100,000, Seaboard Oil Company of Delaware 100,000 acres, Shell Oil Company 50,000 acres, Gulf Oil Corporation 70,000, Amerada Petroleum Corporation 65,000 acres, and Sun Oil Company 55,000 acres.

Oil company leaseholds in Georgia are concentrated in a broad crescent extending from the southwestern corner to the northeastern portion. Sells Petroleum Company is the largest leaseholder with 150,000 acres. Sun Oil Company is represented with 40,000 acres. Other companies hold more than 310,000 acres.

Geophysical activity in the southeastern states is moving to higher and higher peaks, accelerated by recent discoveries in Florida, Alabama and southern Mississippi. The gravity meter method is chiefly used, accounting for more than half the total crew weeks of geophysical activity. Fully 60 gravity meter crews are now employed in the states bordering on the Gulf of Mexico, accounting for 65 per cent of all of the gravity meter crews in use throughout the entire nation. More than 20 reflection seismograph crews are working the southeastern states, or seven and one-half per cent of the total seismic activity in the United States. The magnetometer was employed to a small extent during 1941 and 1942 in Florida on an average of 85 crew weeks a year, and an average of 60 crew weeks annually in Mississippi. The core-drill is widely-used to prove geophysical data, principally in southern Mississippi and Florida.

Of the gravity meter crews operating in the southeastern states, more than one-half are working in southern Mississippi, the remainder in decreasing order in Alabama, Florida and Georgia.

Seismic exploration in the province is currently finding great popularity in southern Mississippi, more than 90 per cent of the crews used in the southeastern states being utilized in Mississippi. The reflection seismograph method has been credited with discovery of the Cranfield and Brookhaven fields, while the gravity meter found Heidelberg and Eucutta fields in Mississippi. Interior salt domes in that state found with the seismograph include Midway in Lamar county, Oakvale in Jefferson Davis county and Newman in Warren county.

Statistical analysis of geophysical activity in the southeastern states during 1942 when 1,811 crew weeks were reported, indicate that 48 per cent or 873 crew weeks comprised gravity meter work, 42 per cent or 757 crew weeks with the reflection seismograph, and 10 per cent or 181 crew weeks with the magnetometer.

TABLE I

Exploration Activity

A. Geophysical Summary (1942)

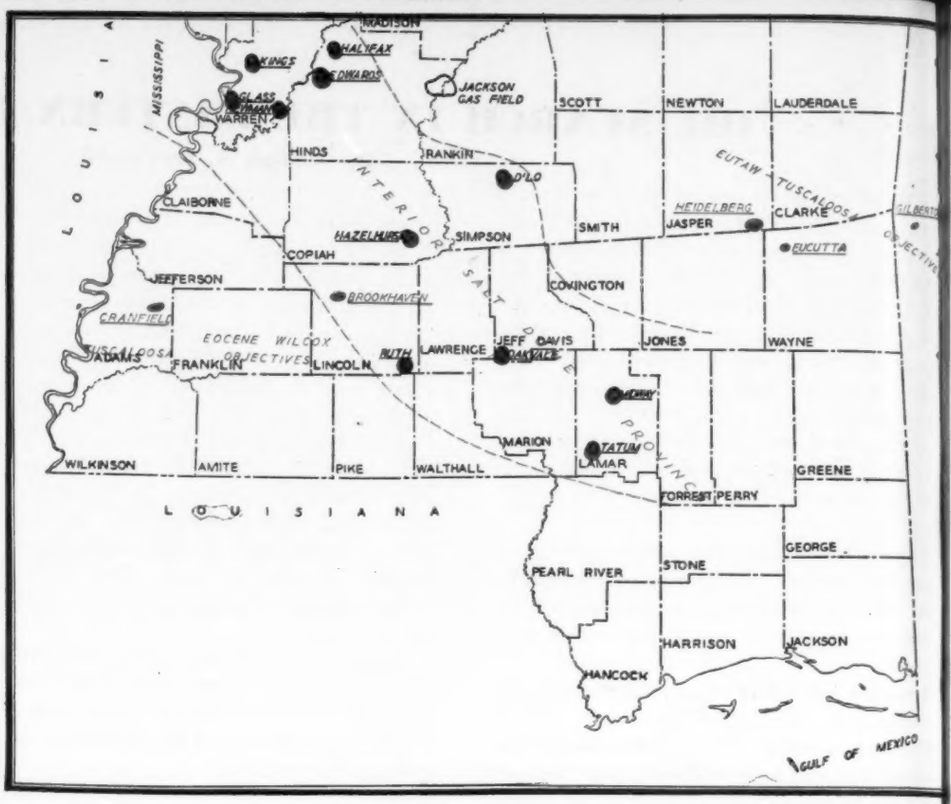
State	Gravity Meter Crew Weeks	Seismograph Crew Weeks	Magnetometer Crew Weeks
Alabama ...	167	16	25
Florida	123	17	80
Georgia	97	...	...
Mississippi ..	486	724	76
Totals, Eastern Gulf Prov.	873	757	181

B. Core Drilling

Alabama	...
Florida	93
Georgia	...
Mississippi	172

Data from Year Book 1943 (Review of 1942), National Oil Scouts & Landmen's Association

Volume of exploratory drilling in the southeastern states is at its highest level since 1940 when all-time high of 692,138 feet of wildcat wells were drilled. Total annual exploratory drilling footage in the southeastern states rose from 274,144 feet in 1941 to 366,331 feet in



Map of Southern Mississippi Showing Current Development in Red.

1942 and to 460,223 feet in 1943. The increase in exploratory drilling footage is due to the rapidly accelerating change in drilling depths, principally in southern Mississippi. (See accompanying table on Mississippi exploratory drilling statistics.) Exploratory drilling in Alabama reached its peak in 1940 when 151,493 feet of hole were cut. Mississippi, during 1943 accounted for 72 per cent of all exploratory drilling footage.

Florida today stands on the threshold of an important drilling campaign touched off with the discovery of the Sunniland pool. Monroe, Dade and Collier counties will be the hub of a 10,000-foot drill campaign that will materially increase the part Florida is playing in the exploratory drilling footage statistics.

Drilling depth records have passed the 12,000-foot mark both in Alabama and Mississippi. The 7,000-foot mark has been reached in Georgia and the 11,000-foot level in Florida. The accompanying table shows the annual drilling depth records for these four states.

TABLE II

Drilling Footage Statistics: Exploratory Tests
(For 5-year Period, 1939 to 1943 incl.)
Total Annual Exploratory Drilling Footage

State	1939	1940	1941	1942	1943
Alabama	20,579	151,493[a]	20,816	26,910	35,777
Florida	10,208	4,822	600	12,635	35,124[a]
Georgia	7,154	2,721	1,935	10,323[a]	10,037
Mississippi	77,867	533,097[a]	250,793	316,563	379,285
Annual Totals	115,808	692,133	274,144	366,431	460,223

[a] Peak year for 5-year period.
Source: Frederic H. Lahee, Sun Oil Company, Dallas, Texas.

TABLE III

Trends in Exploratory Drilling in Mississippi
(For 5-Year Period, 1939 to 1943 incl.)

Year	No. of Wildcats Drilled	Total Drilling Footage	Average Depth Per Expl. Text	Impetus to Exploration
1939	18	77,867	4,326	Tinsley Field Discovery
1940	109	533,097	4,891	Pickens Field Discovery
1941	52	250,793	4,826	Sharpsburg Field Discovery
1942	60	316,563	5,276	"L. Massive Sand" Discovery[a]
1943	56	379,285	6,773	Brookhaven, Cranfield Pools

[a] Semi-Commercial Oil Production developed from this member of the Marine Tuscaloosa formation at Pure Oil Company's No. 1 McDowell, C SE SE/4 Sec. 1, Twp. 6 N., R. 4 W., Adams County, Mississippi.
Source Frederic H. Lahee, Sun Oil Company, Dallas, Texas.

TABLE IV

Drilling Depth Records

Year	County	Total Depth	Deepest Formation Reached	Operator	Location
			Alabama		
1927	Choctaw	7,511	.....	Joe Modisett	S. 20, T. 9 N. R. 2W.
1940	Choctaw	9,700	.....	Union Producing	S. 20, T. 9 N. R. 2W.
1941	Clarke	12,399	Pennsylvanian (Pottsville)	Union Producing	S. 27, T. 8 N. R. 1W.
			Georgia		
1938	Pierce	4,375	Pre-Cambrian	Pan-American	
1943	Early	7,320	Quartzitic Ss.	Warren & Robinson	Land Lot 406
			Florida		
1928	Marion	6,180	Pre-Cambrian	Ocala Oil Corp.,	S. 10, T. 16 S., R 20E.
1939	Monroe	10,006	L. Cretaceous	Peninsular Oil	S. 6, T. 55 S., R 34E.
1943	Collier	11,626	L. Cretaceous	Humble Oil & Ref.	S. 29, T. 48 S., R 30E.
			Mississippi		
1935	Stone	7,443	Eutaw	Gulf Ref. Co.	S. 36, T. 3 S., R 11W.
1940	Scott	10,365	Paluxy	Gulf Ref. Co.	S. 5, T. 6 N. R. 7 E.
1941	Lawrence	10,808	Tuscaloosa	Tide Water Assoc.	S. 5, T. 5 N. R 11 E.
1942	Franklin	11,802	Comanchean (L. Glen Rose Ls.)	Amerada Petroleum	S. 10, T. 7 N., R. 3E.
1943	Lincoln	12,229	.....	The California Co.	S. 4, T. 7 N., R 7E.

Average depth per wildcat well has risen sharply in Mississippi from 4,826 feet in 1941 to 5,276 feet in 1942, and to 6,773 feet in 1943. The current year should reveal a continuation of that trend due to the widespread exploration for the rich "Massive sand" member of the Tuscaloosa formation which underlies most of southern Mississippi.

Background of exploration and development of the first oil pool in Florida starts with a 10,006 feet rank wildcat test drilled in the Everglades region, 50 miles west of Miami in Monroe county five years ago. It was known as Peninsular Oil and Refining Company, Tampa, Florida, No. 1 J. W. Cory, located in the center of the northwest quarter of Section 6, Township 55 S., Range 34 E. Drilling was started on December 31, 1938 and the well was abandoned on May 27, 1939 in the equivalent of the Edwards formation of Texas (lower Cretaceous age). Oil showings were noted at various points cored throughout the Cretaceous rocks from 8,900 feet to total depth, in limestone and anhydrite samples. The logging of extremely-porous dolomitic limestone in this lower section was one factor contributing towards renewed exploration. More than 4,250 feet of Cretaceous limestone, anhydrite and chalk section was penetrated; the well being completed still in oil-stained limestone with the base of the formation unreached. Not only did this deep failure prove the existence of a Cretaceous basin in southern Florida but the occurrence of a section of lower Cretaceous rocks not found elsewhere in the state pointed to a regional stratigraphic wedge.

Encouraged by the favorable geologic conditions and oil showings logged in the Cory well, Humble Oil and Refining Company carried on during 1942 a comprehensive geological and geo-

physical exploration program in Collier, Dade, Hendry and Monroe counties in the southern portion of the peninsula. Favorable surface geologic data were verified by core-drilling operations conducted by Humble's own crews who worked for 36 drill-weeks near Sunniland in Collier county in townships 47 and 48 south, ranges 29 and 30 east. Anticlinal structure was further indicated by geophysical instruments, which surveyed the area also during 1942. Late the same year Humble staked location for their No. 1 Gulf Coast Realties Corporation in the center of the southwest of the southeast quarter of Section 29, Township 48 South, Range 30 East in the same section as the town of Sunniland. The first deep test to be drilled under the Humble Banner in Florida, it was situated 42 miles northwest of the Peninsular-Cory dry hole. Drilled in the heart of the Everglades, it is in the Big Cypress Swamp, 30 miles west of the Seminole Indian Reservation and 40 miles southwest of Lake Okeechobee.

Drilling, completion and initial production data on the discovery well at Sunniland follows:

HUMBLE OIL REFINING COMPANY
No. 1 Gulf Coast Realties Corporation
Location: from the SW cor E/2 Section 29, 684 ft. thence at R/A to the section line, 667 ft. to well site. Section 29, Township 48 South, Range 30 East

Collier County, Florida
Producing Formation: Lower Cretaceous (Undifferentiated)
Top of Upper Cretaceous: 5,770 ft. (5,736 ft. subsea)
Surface Elevation 34 ft. derrick-floor: 17 ft. ground-floor
Drilling Dates: Spudded: February 28, 1943

Completed: November 24, 1943
Drilling Contractor: Loffland Brothers Drilling Co., Tulsa

Casing Record
Surface String 1,644 ft. of 13⅜ in.
Protection String 5,727 ft. of 9⅝ in.
Oil String 11,597.67 ft. of 7-in. O.D.

Final Coring Record

11,587 — 11,606 ft.	cut 19 ft.	recovered limestone, anhydrite;
11,606 — 11,627 ft.	cut 21 ft.	recovered limestone, showing oil;
11,627 — 11,630 ft.	cut 3 ft.	recovered fossiliferous limestone, showing oil
Total net pay section at total depth		13 ft.

Completion Operations
S. L. M. Corr. 11,630 ft. equals 11,626 ft. Schlumberger 11,626 to 1,640 ft. Set oil string on Oct. 11, 1943, drilled out cement plug on Oct. 14, 1943. Swabbed 180 bbl oil, 375 bbls. B. S. 115 bblwtr. 2 days. Initial completion on Nov. 24, 1943 for 140 bbl. net oil plus 65 per cent of salt water (tests 284,000 p.p.m.); gravity 20 deg. A.P.I.; color of crude oil: black. Bottom-hole temperature 227 deg. Fahr.

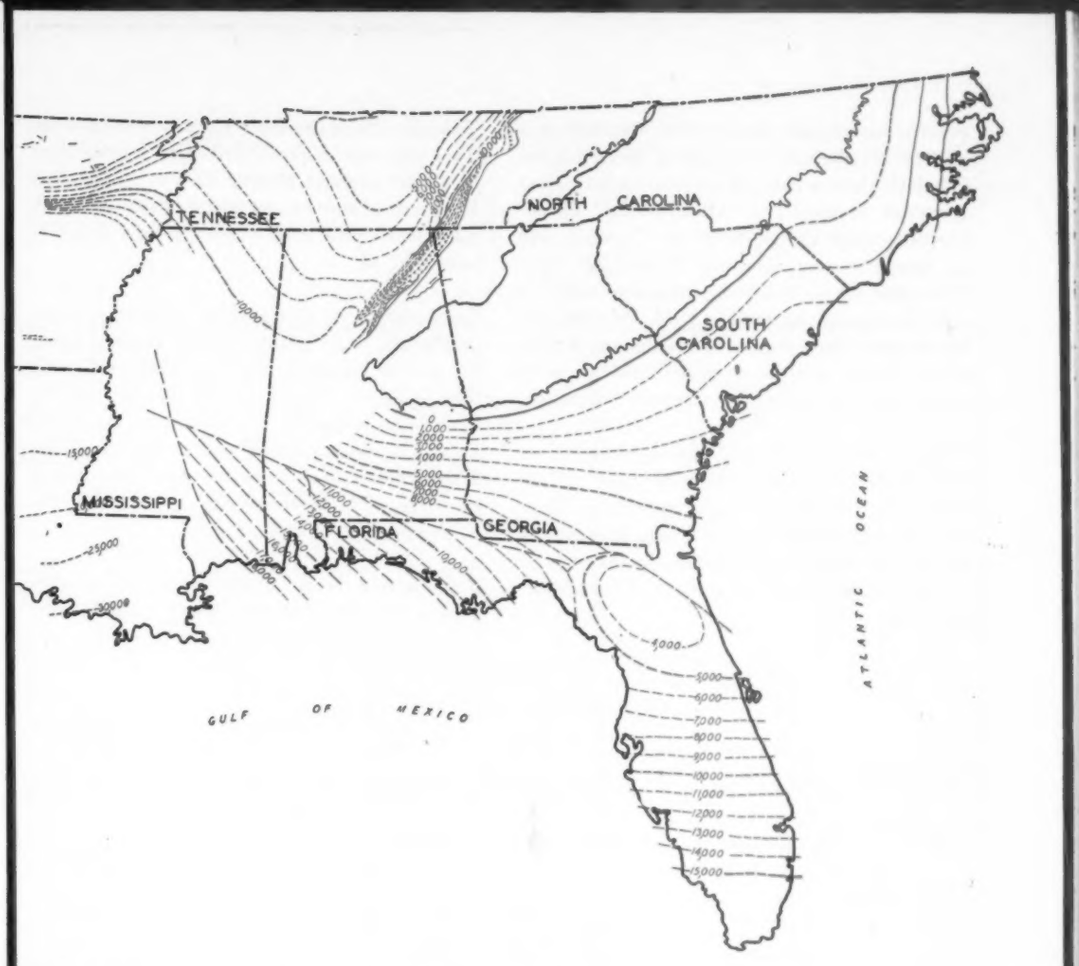
A net pay section of 13 feet was recovered from the last two cores as shown on the accompanying well summary. Drilling operations were halted at a corrected total depth of 11,626 ft. as determined by steel line measurement. Schlumberger electrical logging electrodes were run to total depth and the hole surveyed up to 1,640 feet. The oil string was run on October 11, 1943 and comprised 11,598 feet of 7-in. O. D. pipe. When the cement plug was drilled out three days later, the well failed to flow, but on initial swabbing tests made 180 barrels of oil, 375 barrels of basic sediment and 115 barrels of water in two days. Pumping equipment was then installed and the well completed on November 24 for an initial pumping production of 140 barrels of net oil plus 65 per cent of salt water, testing 284,000 parts per million. The gravity of the oil was 20 deg. A. P. I. However, the crude is unusually fluid for such a low gravity.

By January 1, 1944, 4,032 barrels of net oil had been produced. The crude is being stored at the well, additional storage being erected according to production needs.

The second test on the Sunniland structure was started less than six weeks from the date of completion of the discovery well approximately one mile to the west. Humble's No. 2 Gulf Coast Realties Corporation was staked 2,000 feet from the east line and 667 feet from the south line of Section 30. Crews set 117 feet of 26-inch conductor pipe. At a depth of 850 feet, a surface string of 20-inch pipe was set. The next string consisted of 1,492 feet of 13⅜ inch pipe while the protection string was 5,660 ft of 9⅝-in pipe. The top of the Upper Cretaceous formations was logged approximately at the same depth as in the discovery well and at the time of this writing was coring near 11,000 feet for the discovery pay.

Meanwhile, Humble geologists and geophysical crews rechecked company holdings throughout southern Florida. Early in March of 1944, Humble staked location for a wildcat test in Dade county, 12 miles southeast of the Monroe county failure of Peninsular Oil and Refining Company's No. 1 Cory. The new location was their No. 1 State in the center of the northeast of the northwest quarter of Section 30, Township 55 South, Range 36 East.

The same month, William G. Blanchard staked location for a Dade county wildcat at his No. 1 Grosman, 1,980 feet from the south line and 2,640 feet from the west line of Section 25, Township 55 South, Range 37 East. It is 16 miles east and south of the Peninsular-Cory dry hole, and 28 miles west of Miami. Meanwhile, drilling interest followed the Dade county deep test of same interests No. 1 Everglades in Section 31, Township 53 South, Range 35 East, which was drilling below 8,300 feet. It is 35 miles southeast of the Sunniland discovery well.



CONFIGURATION OF BASEMENT COMPLEX — EASTERN GULF PROVINCE (IN PART AFTER MOSS, AM. GEO. UN.)

SOUTHERN MISSISSIPPI

Major exploration and drilling objective in southern Mississippi is the "Massive sand" of the lower Tuscaloosa formation. To date three commercial oil fields have been discovered in this province from the formation across a belt extending from the Mississippi river to the Alabama border. Depth to production ranges as shallow as 6,667 feet in the Eucutta field of Wayne county, to 10,282 feet in the Brookhaven field of Lincoln county. The gravity meter principal geophysical method used in southern Mississippi

exploration, shared honors with the reflection seismograph method in localizing the structures in which these accumulations are found. Most important of the three "Massive sand" discoveries at present appears to be the Cranfield pool in Adams county near the Mississippi river, where the first oil well completion from this deep zone was brought in early in 1944. Market outlets for these deep discoveries are limited at present to the use of pipe-line laterals and trucks to nearby loading racks for interstate shipment.

Economic factors affecting the development of these fields include the relatively great drilling depth, the generally low gravity of the oil at Eucutta and Brookhaven (40 deg. high-gravity oil at Cranfield) and the relatively lower price at the well for the oil on account of transportation costs.

TABLE V

Oil Pools in the Eastern Gulf Region

State & County	Name of Pool	Disc. Date	Depth to Pay	Name of Oil Pay	Age of Prod. Hor.	Total Wells	Exploration Method
ALABAMA							
Choctaw	Gilbertown	3-10-44	2,575	Selma Ch.	U. Cret.	2	.....
FLORIDA							
Collier	Sunniland	11-24-43	11,606	foss. lm.	L. Cret.	1	Surface Geophysics Core Drill
MISSISSIPPI							
Adams	Cranfield	10- 4-43	5,880	Wilcox Sd.	Eocene	5	Seismograph
		1-24-44	10,226	Massive Sd.	U. Cret.		
Jasper	Heidelberg	2- 8-44	4,958	Tuscal.	U. Cret.	3	Gravity Meter
Lincoln	Brookhaven	3- 9-43	10,289	Massive S.	U. Cret.		Gravity Meter Seismograph
Madison	Flora	9- 7-43	4,360	Gas Rk.	U. Cret.	2	Seismograph
Madison-Yazoo	Vaughan-Pickens	4- 8-40		Tuscaloosa	U. Cret.	33	
Sharkey	Cary	9- 1-41	3,270	Selma	U. Cret.		
Wayne	Eucutta	9- 4-43	6,667	Massive	U. Cret.	3	Gravity Meter Surface Str.
Yazoo	Tinsley	9- 5-39	5,012	Selma Ch.	U. Cret.	337	Surface Str.
				Eutaw	U. Cret.		
				Tuscaloosa	U. Cret.		

A production summary of all fields in southern Mississippi producing from the "Massive sand" follows:

TABLE VI

"Massive Sand" Pool Development

Field	County	Depth of Pay Discovery	Depth to Oil Pay	No. of Wells Compl.	Grav. of Oil	Geophysical Exploration Method
McDowell [a]	Adams	2-15-42	10,240 est.	1 [a]	49.6	.....
Brookhaven	Lincoln	3-11-43	10,282	1	23.0	Grav. Seis.
Eucutta	Wayne	9- 3-43	6,667	2	16.8	Gravity Meter
Cranfield	Adams	1-24-44 [b]	10,226	3	40.0	Seismograph

[a] Abandoned discovery well; Pure Oil Company's No. 1 McDowell, in Section 1 Township 6 North, Range 4 West, produced only 650 barrels of oil before premature abandonment.
[b] Discovery date for "Massive sand"; "Wilcox" sand zone opened field on October 4, 1943.

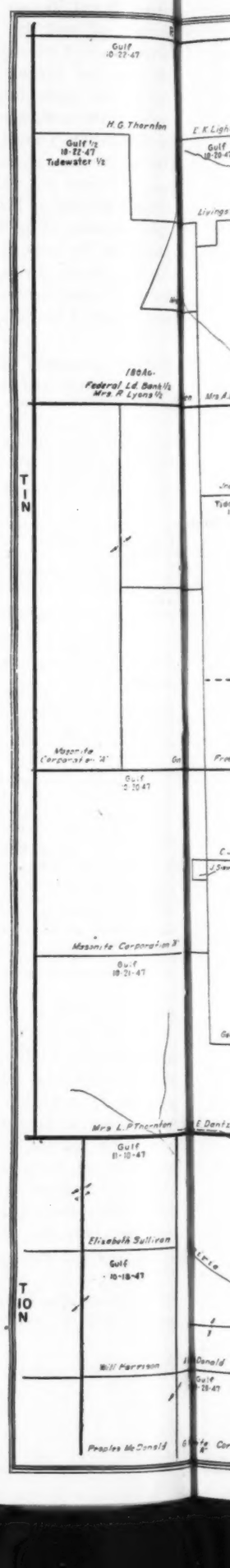
The Tuscaloosa formation (Upper Cretaceous) became a prime exploration objective in southern Mississippi early in 1943. On February 15 of that year, semi-commercial high-gravity oil was indicated at a rank wildcat test five miles southwest of Natchez, less than one mile east of the Mississippi river in Adams county. It was Pure Oil Company's No. 1 McDowell, located in the center southeast of Sec. 1, Twp. 6 N., R. 4W., which flowed 302 barrels of 49.6 gravity oil and 1,500,000 cubic feet of gas in 72 hours using 12/64-inch choke, producing through casing perforations from 10,246 to 10,440 feet from the lower "Massive sand" member of the Tuscaloosa. Tubing pressure initially registered 1,800 pounds. This well was originally drilled to a total depth of 11,107 feet and plugged back to 10,505 feet. Premature water encroachment caused abandonment of the well after it had produced only 650 barrels of oil.

Considerable impetus to deep wildcat drilling, geophysical and leasing activity resulted from the interest created by the Pure-McDowell well. The so-called "Massive sand" member, of the Tuscaloosa formation, was later found to underlie a wide belt stretching as far west as Holly Ridge pool in Tensas parish, Louisiana, across the state of Mississippi nearly to the Alabama-Mississippi state boundary line.

Brookhaven field in Lincoln county, Mississippi, marked the first commercial discovery to be completed in the southern half of the state from the Tuscaloosa. The discovery well, completed on March 10, 1943, was The California Company's No. 1 G. T. Smith, located 594 feet south of the north line and 604 feet east of the west line of Sec. 4, T. 7 N., R. 7 E., which flowed from 25 to 30 barrels of 23 gravity oil daily from casing perforations from 10,288 to 10,322 feet on initial production tests. Originally, this pool-opener was drilled to a total depth of 12,229 feet and plugged back to 10,460 feet, setting a drilling depth record for the state at that time. It was situated on a geophysical prospect indicated by the gravity meter and the reflection seismograph. The California Company employed a seismograph crew for six weeks in the area during 1942 on the basis of which they expanded the discovery block. During 1943, the discovery well produced 16,710 barrels of oil.

The completion and lithology data on the discovery oil well of the Brookhaven pool follows:

Heidelberg Development and Surrounding Area.



THE CALIFORNIA COMPANY

No. 1 G. T. Smith

Lcn: 594 ft. S. of N. L., and 604 ft. E. of W. L. Sec. 4, Twp. 7 N., Rge. 7 E

Brookhaven Pool Discovery Well

Lincoln County, Mississippi

Producing Formation: Tuscaloosa (U. Cret.) "Massive Sand"

Surface Elevation: 491 ft. d. f.

Drlg. Cpl. March 11, 1943

Formation Tops

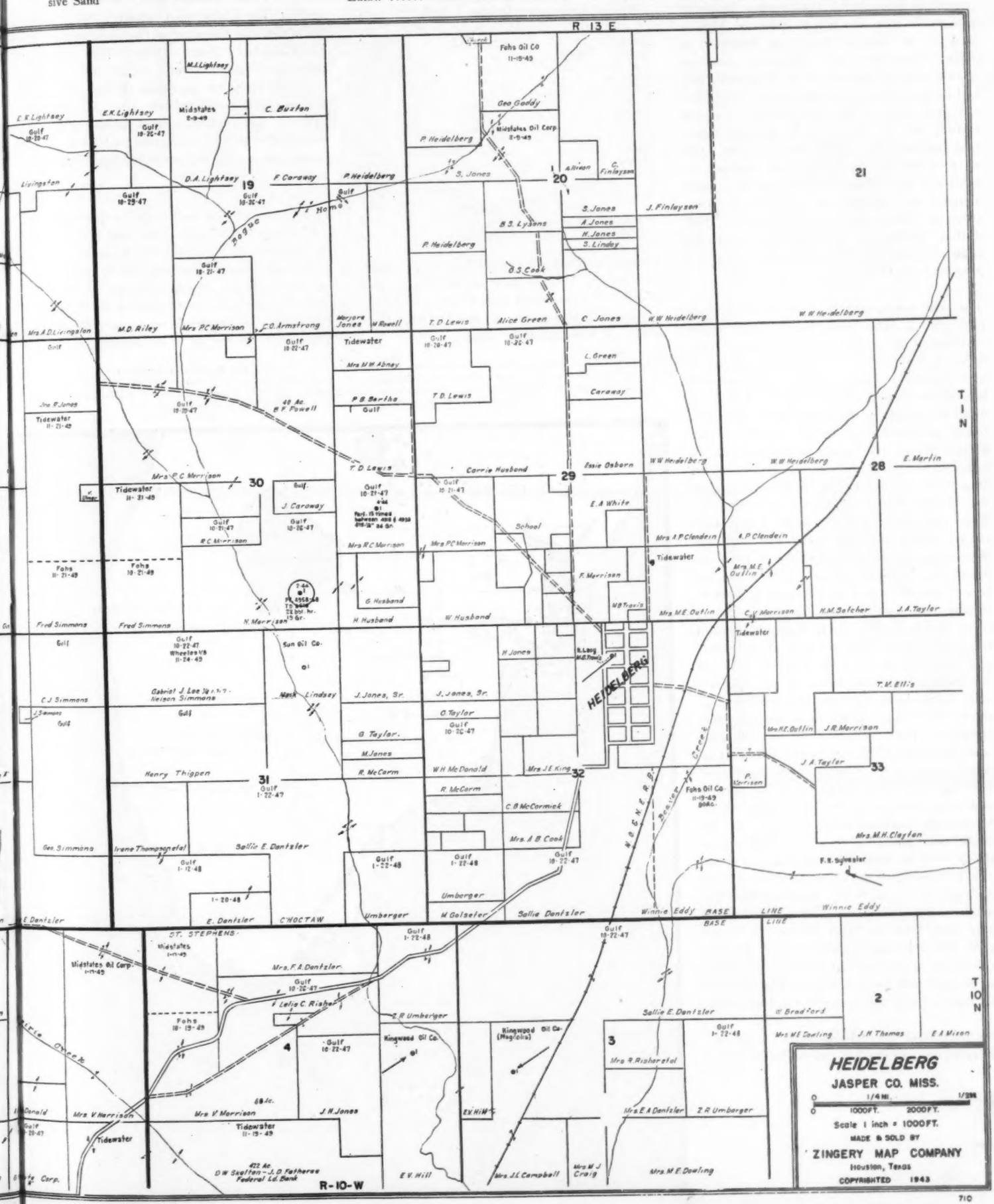
Tallahatta	3,706
Wilcox	3,945
Midway	7,264
Selma Chalk	8,251
Eutaw	9,294
Tuscaloosa Formation	9,395
Marine Tuscaloosa	9,930
"Massive Sand" Member	10,282
Lower Cretaceous	10,326
Total Depth	12,229

Casing Record:

Surface pipe: 107 ft. of 20-in.

Protection pipe: 1,213 ft. of 13⅜-in.

Oil pipe: 10,599 ft. of 7-in. 12,229 ft. of 5-in.



Drilled to total depth of 12,229 feet; set 5-in. pipe on bottom; perforated from 10,288 to 10,322 feet; initial production 25 to 30 bbl. 23 gravity oil daily, from "Massive sand" of Tuscaloosa formation.

Eucutta field in Wayne county, Mississippi, discovered on September 4, 1943 marked the second pool strike from the broadly-deposited Massive sand of the Marine Tuscaloosa formation of Upper Cretaceous age. Discovery came six months after the opening of the Brookhaven field in Lincoln county, which marked the initial Massive sand discovery for the province. Eucutta, situated only 23 miles from the Alabama-Mississippi boundary line, already has more than 1,000 acres of ultimate productive area outlined for production by drilling. Although the field gained a second and shallower oil producing formation from the Eutaw sand during February, 1944, drilling development has been slow due to the relatively small completion well sizes and erratic producing conditions.

The field was opened by Gulf Refining Company's No. 1 Allen Davis, located in the center northeast of the southeast quarter of Sec. 2, twp. 9 N., R. 9 W., which was drilled on a prospect first mapped by surface structure and confirmed by gravity meter geophysical survey. A showing of oil was logged in the Eutaw sand. However, initial completion was for 178 barrels of 16.8 gravity oil and 110 barrels of salt water in 24 hours on the pump through casing perforations from 6,666 to 6,672 feet in the Massive sand of the Marine Tuscaloosa topped at 6,505 feet. Total depth was 7,100 feet in the Lower Cretaceous topped at 7,000 feet. The well was placed on actual production October 3, 1943, one month after official completion. The Eutaw sand horizon was discovered on February 6, 1944 by Humble Oil and Refining Company's No. 1 Gulf, Mobile & Ohio R. R. Company, located 1,992 feet, south, 730 feet east of the northwest corner of Sec. 1, Twp. 9 N., R. 9 W., at the diagonal northeast offset to the discovery well. Initial production was nine barrels of 27 gravity oil per hour on the pump through casing perforations from 5,058 to 5,070 feet. Original total depth was 6,807 feet in the Marine Tuscaloosa topped at 6,327 feet. No showings of oil were logged in either the Davis or the Massive sand which produced in the field discovery well. A one-mile northeastward extension of the Eutaw sand producing area was made during March 1944 by Gulf Refining Company's No. 1 G. S. Stanely, in the center southeast of Sec. 36, Twp. 10 N., R. 9 W., which swabbed 210 barrels of pipe line oil in 10 hours through 48 shots from 5,046 to 5,054 feet in the Eutaw sand. The well was carried to a total depth of 10,055 feet in the Lower Cretaceous before being plugged back and completed. The electrical log indicated only salt water in the Davis sand.

The completion and lithology data on the discovery oil well of the Eucutta pool follows:

GULF REFINING COMPANY
No. 1 Allen Davis
Lcn: 660 ft. South, 660 ft. West of NE Cor, SE/4 Sec. 2, Twp. 9 N., R. 9 W
Eucutta Pool Discovery Well
Wayne County, Mississippi
Producing Formation: Massive Sand (U. Cretaceous)
Surface Elevation: 314.10 g. f.
Completed: September 4, 1943
Placed on Production: October 4, 1943

Formation Tops

Jackson	193
Moody's Branch	415
Cockfield	490
Wautubee	593
Sparta lime	654
Tallahatta	943
Wilcox	1,260
Midway	3,330
Upper Cretaceous	3,950
Eutaw	5,140
Marine Tuscaloosa	6,505
Massive sand	5,666
Lower Cretaceous	7,000
Total Depth	7,100

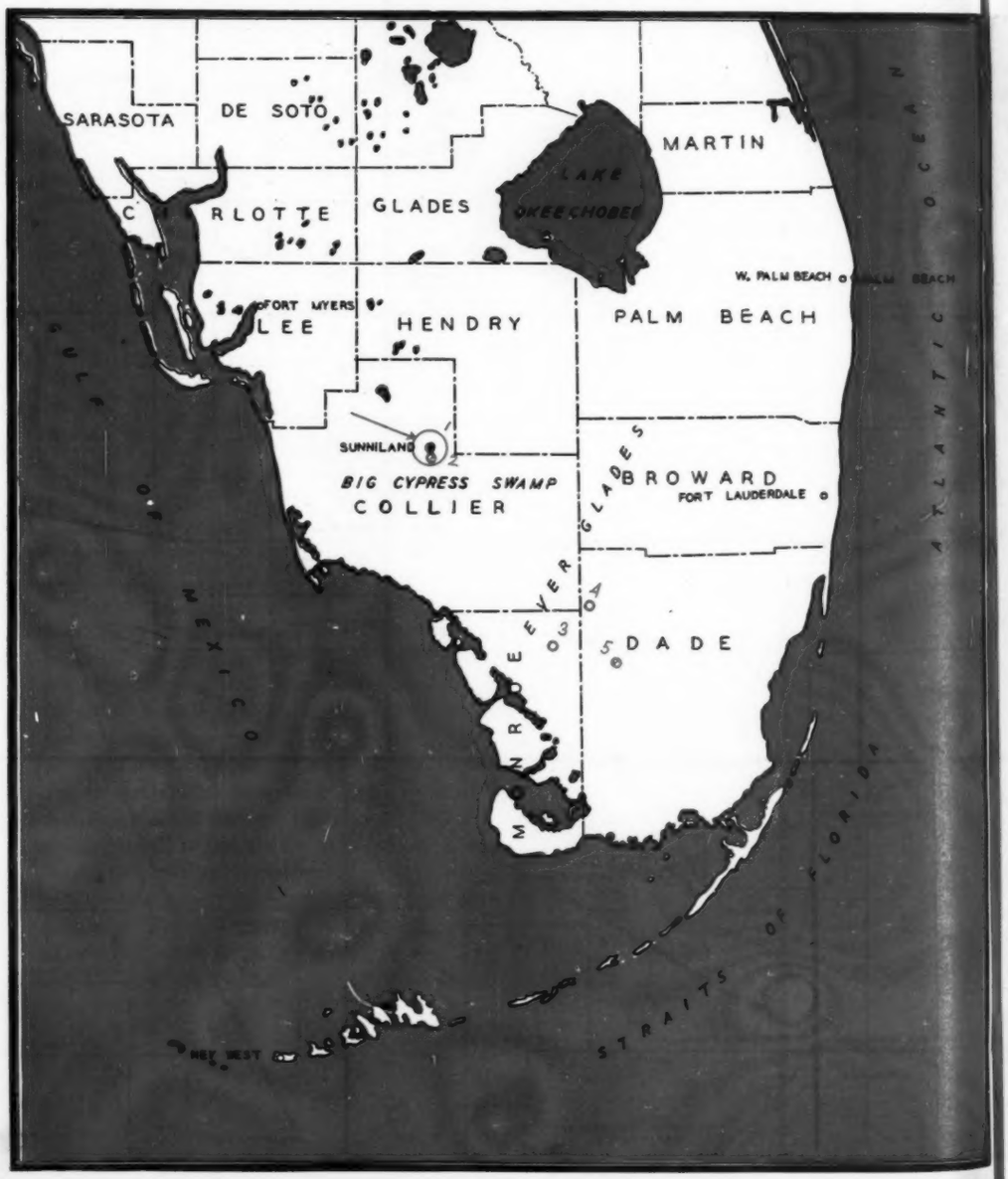
Casing Record
Surface Pipe: 10¾-in. at 742 ft.
Oil String: 5½-in at 6,851 ft.

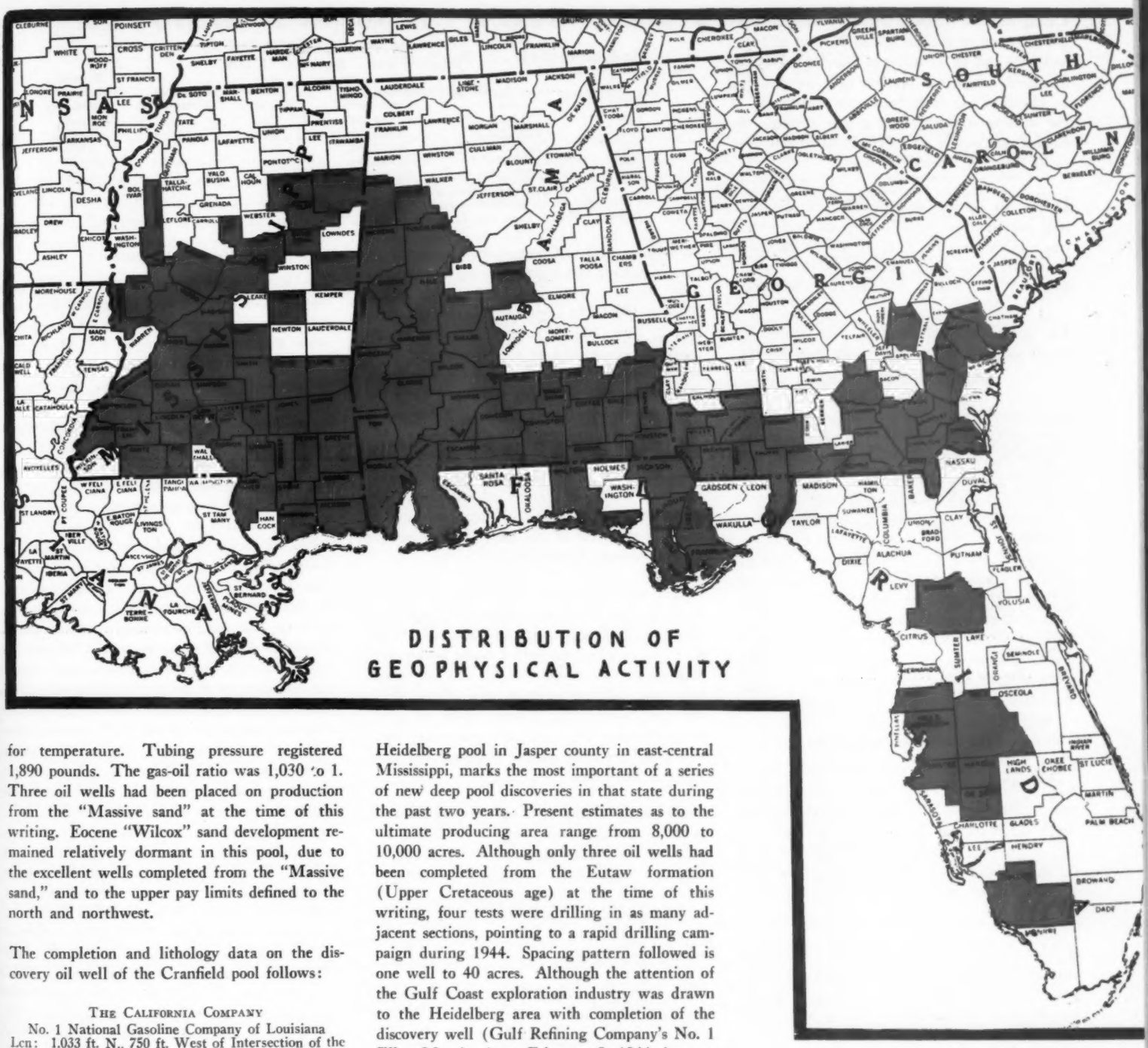
Completion Data: Electrical log to total depth of 7,100 ft. Plugged back and set 5½ in. pipe at 6,851 ft.; perforated from 6,666 — 6,672 ft.; pumped 178 16.8 gravity oil and 110 bbl. of salt water in 24 hours on the pump.

Cranfield pool in Adams County, the third commercial oil pool to be completed to date in the state from the "Massive sand" member of the lower Tuscaloosa formation, marks an important reserve for southern Mississippi in the making. A straw-colored oil and gas showing was recovered from the "Massive sand" in the discovery well at The California Company's No. 1 National Gasoline Company of Louisiana in Section 52, Township 7 North, Range 1 West through casing perforations around 10,226 feet. However, the zone was squeezed off and the well plugged back for completion from the Eocene "Wilcox" sand. Shallow offset drilling that followed failed to find production, at least two adjacent tests proving dry in the 5,880-ft. "Wilcox" zone.

First commercial oil well to be completed from the "Massive sand" zone in the field lies west of the discovery at The California Company's No. 2 National Gasoline Company, which flowed 350 barrels of pipe line oil a day through a 5/32-inch choke through casing perforations from 10,343 to 10,381 feet, on completion on January 25, 1944. The gravity of the oil is 40 degrees, corrected

Map of Southern Florida Exploration: (1) Humbles's No. 1 Gulf Coast Realties at Sunniland; (2) Humbles's No. 2 Gulf Coast, Now Drilling; (3) Peninsular Oil's No. 1 Cory, Dry Hole; (4) William G. Blanchard's No. 1 Everglades, Now Drilling and (5) Blanchard's No. 1 Grosman, Recent Location. Base Map, Courtesy Rand-McNally & Company.





for temperature. Tubing pressure registered 1,890 pounds. The gas-oil ratio was 1,030 to 1. Three oil wells had been placed on production from the "Massive sand" at the time of this writing. Eocene "Wilcox" sand development remained relatively dormant in this pool, due to the excellent wells completed from the "Massive sand," and to the upper pay limits defined to the north and northwest.

The completion and lithology data on the discovery oil well of the Cranfield pool follows:

THE CALIFORNIA COMPANY
No. 1 National Gasoline Company of Louisiana
Lcn: 1,033 ft. N., 750 ft. West of Intersection of the Cannonsburg Road and the North line of U. S. Highway 84
Sec. 52, Twp 7 N., R 1 W.,
Prod. Fmtn: Eocene "Wilcox" Sand Discovery Well (Tested gas-distillate from the "Massive Sand")

Cranfield Pool
Adams County, Mississippi
Surface Elevation: 387 feet
Drlg. Completed: October 5, 1943

Formation Tops

Sparta	3,031
Cane River	3,800
Wilcox	4,120
Massive Sand	10,226–10,276
Total Depth	10,383

Casing Record
Surface Pipe: 170 ft. of 16-in.
Protection Pipe: 1,784 ft. of 10¾ in.
Oil Pipe: 10,383 ft. of 7-in.

Heidelberg pool in Jasper county in east-central Mississippi, marks the most important of a series of new deep pool discoveries in that state during the past two years. Present estimates as to the ultimate producing area range from 8,000 to 10,000 acres. Although only three oil wells had been completed from the Eutaw formation (Upper Cretaceous age) at the time of this writing, four tests were drilling in as many adjacent sections, pointing to a rapid drilling campaign during 1944. Spacing pattern followed is one well to 40 acres. Although the attention of the Gulf Coast exploration industry was drawn to the Heidelberg area with completion of the discovery well (Gulf Refining Company's No. 1 Ellen Morrison) on February 8, 1944, impetus was given the development two months later when the diagonal northeast offset (Gulf's No. 1 Lewis-Morrison Unit) logged 179 feet of net pay sand in the same formation; the latter completion for 1,001 barrels of 24.4 gravity oil in 24 hours through a 22/64-inch choke (from perforations in 7 sections between 4,837 to 4,948 feet) marked the largest initial daily gauge recorded to date from any well in the eastern gulf region.

Structure of the Heidelberg field, like Tinsley, is featured by at least one major fault and a number of cross faults. The discovery well cut a fault in the top of the Eutaw formation. A displacement of 348 feet (measured on top of the Eutaw) is recorded between the discovery completion and the diagonal northeast offset referred to above.

Principal lease owners in this new producing area besides the Gulf Refining company, include Mid States Oil Corporation, Fohs Oil Company, and Tide Water Oil Company. The presence of a large number of small irregular tracts should offer no great difficulty to orderly development since unitization agreements are being made to form 40-acre units to comply with PAW spacing regulations.

Casing practice followed at Heidelberg employs a surface string of from 500 to 932 feet of 10¾-inch pipe and an oil string of 7-inch O. D. pipe. Standard completion practice calls for running an electrical log from bottom on completion of the drilling contract, setting pipe through the Eutaw sand section and perforating all saturated sands indicated on electrical log.

Deeper pay possibilities explored in the discovery well proved discouraging when salt water sand was cored from 6,025 to 6,238 feet in the top of the Davis sand which produces in the Eucutta field of Wayne county, 15 miles to the southeast.

The completion and lithology data on the discovery oil well of the Heidelberg pool follows:

GULF REFINING COMPANY

No. 1 Ellen Morrison

Lcn: 669 ft. N. and W. of SE Cor., SW/4 SE/4 Sec. 30, Twp I N., Rge. 13 E.
Heidelberg Pool Discovery Well.
Jasper County, Mississippi
Producing Formation: Eutaw (U. Cret.)
Surface Elevation: 322 d. f.
Drlg. Dates: Started November 11, 1943

Completed February 8, 1944

Formation Tops

Wautubee	496
Camerina Lime	525
Wilcox (Eocene)	1,120
Midway (Eocene)	3,160
Selma Chalk	3,693
Eutaw	4,742
Tuscaloosa	4,993
Marine Tuscaloosa	5,872
Davis (Eucutta Pay)	6,017
Comanchean (L. Cret.)	6,405
Total Depth	6,578

Tests and Completion Data

Drill-stem test 4,910-4,936; tester open for 15 min. ¼-in. chokes; Rec. 580 ft. of clean 23.8 grav. oil; bottom-hole pressure 400 pounds; total depth, 6,578 ft.; ran Schlumberger log; set 7-in. csg. at 5,074 ft.; perforated 4,958-4,968 ft. with 60 shots; init. prod. 258 bbl. 20⅛ hrs. thru 18/64-in. choke; corr. gravity 19 deg.; tbg. press. 140 lb.

Tinsley pool in Yazoo county in the west-central part of Mississippi represents the most important past oil development in the eastern gulf region in cumulative production, producing area, number of wells and multiplicity of pay sands. During a period of less than five years this field has produced 65,064,178 barrels of crude oil (to January 1, 1943). The peak production year was 1942 when 28,177,484 barrels of oil were reported. Now completely defined, the field extends eight miles in length and from two to three miles in width, covering 9,840 acres. Structure is a faulted dome with numerous cross faults. Seven producing sands have been developed to date, averaging 30 feet in pay thickness from the Selma formation, the Eutaw and Tuscaloosa sands, all of Upper Cretaceous age. The gravity of the oil ranges from 31.6 to 49.6 degrees API. The average producing depth is 5,014 feet. The production history of the field is summarized in the following table:

TABLE VII

Production Record of Tinsley Pool
Discovery Date: September 13, 1939

Year	Crude Oil Production Annual	Crude Oil Production Cumulative	Oil Well Completions Annual	Oil Well Completions Cumulative	Proven Acreage Cumulative
1939	114,968	114,969	8	8	640
1940	4,209,223	4,324,192	104	112	5,880
1941	15,277,273	19,602,264	214 [a]	326	9,840
1942	28,177,484 [b]	47,781,794	6	332	9,840
1943	17,282,384	65,064,178	4	336	9,840

[a] peak oil well completions year
[b] peak annual production year
Source: Petrol. Dev. and Tech. A. I. M. E., 1939—1943 incl.

Gilbertown pool in Choctaw county marked the first recognized commercial oil well for Alabama. The discovery well, completed during March 1944, is Hunt Oil Company, No. 1 Jackson, in Sec. 2, Twp. 10, N. R. 4 W., Originally, the discovery was drilled to a total depth of 5,380 feet in barren "Massive Sand" of the Tuscaloosa. Five-inch and 7-inch casing was set at 2,559 feet and porosity tested from 2,575 to 2,585 feet in the Selma chalk of the Upper Cretaceous. Initially, the well flowed two barrels of oil per hour following swabbing operations but production fell off to 15 barrels of oil daily. The gravity is 17 deg. Baume. Nearest field lies 30 miles to the west in the new Eucutta field of Wayne county, Mississippi.

Deeper producing zone possibilities were indicated the same month when Hunt Oil Company's No. 1 J. T. Doggett, Sr., in Sec. 2, R. 10 N. R. 4 W., cored oil saturation in the Eutaw sand with recovery of 200 feet of oil, 200 feet of salt water and 200 feet of mud on a 20-min. drill-stem test using ¼-in. bottom choke, at 3,565 to 3,570 feet. Oil, mud and salt water were recovered later from another drill-stem test from 3,609 to 3,614 feet.

Development of the area has been discouraged by the erratic porosities found in the Selma formation. The Eutaw sand appears at present to offer best possibilities. Coupled with recent oil discoveries at Heidelberg and Eucutta near the Mississippi-Alabama border line, the Gilbertown discovery while not in itself of importance, has revived exploration in southern Alabama.

While Gilbertown marks the initial oil discovery, small gas pools have been developed in the past at Fayette and at Huntsville in the Paleozoic province in the northwestern corner of the state.

Regional Structure

The Hatchetigbee anticline and related faults comprise one of the major recognized structural features of southwestern Alabama. Over the anticline proper, the strike is N. 55° W, turning to a nearly North-South direction near the Jackson fault on the southeast side. Its shape is asymetric, steeper dips having been observed on its southwestern side than on the northeastern.

Associated faults include the Jackson fault which has an arcuate form and a maximum displacement of 1,500 feet as shown from core-drill data as measured on the Salt Mountain limestone; the Frankville fault on the south flank of the anticline with a displacement to the south from 200 to 300 feet; and the West Bend fault situated in the syncline northward with displacement of 750 feet, downthrown to the south. Maximum reversal of as much as 1,500 feet has been mapped on the northeast flank of the structure. The origin of the structure has been interpreted as a buried salt ridge from gravity minima which are similar in intensity and extent to those found in connection with salt domes in other parts of the Gulf Coast* but there is no marked magnetic effect from either the Hatchetigbee anticline nor the associated Jackson fault. Drilling development for oil to date has proven unsuccessful although nine test wells have been drilled into the Cretaceous, of which six have reached the Tuscaloosa sand. The deepest test is the Clarke county wildcat of Union Producing Company's No. 1 M. M. Waite, in the center of the northwest quarter of Sec. 27, T. 8 N., R. 1 W., which was abandoned during October, 1941 at a total depth of 12,399 feet in the Eagle Mills formation (of upper Jurassic age) consisting of salt which is interbedded with anhydrite, shaly lime and siltstone.

* E. V. McCollum, Geophysics, Vol. 8, No. 1, January 1943.

TABLE VIII

Interior Salt Domes of Mississippi

County	Name of Dome	Location	Method of Dome Disc.
Lamar	Midway	Twp. 4 N., Rge. 15 W.	Seismograph
	Tatum	Twp. 2 N., Rge. 16 W.	Surface Seis.
Jefferson Davis	Oakvale	Twp. 6 N., Rge. 19 W.	.....
Lincoln	Ruth	Twp. 5 N., Rge. 9 W.	.....
Copiah	Hazelhurst	Twp. 10 N., Rge. 9 W.	.....
Warren	Glass	Twp. 14 N., R. 3 W.	Surface
	Kings	Twp. 7 N., R. 4 E.	.....
	Newman	Twp. 14 N., R. 4 W.	Seis. Gravity Meter
Hinds	Halifax	Twp. 7 N., R. 4 W.	.....
	Edwards	Twp. 6 N., R. 4 W.	.....
Simpson	D'Lo	Twp. 2 N., R. 4 E.	.....

NATURAL GASOLINE: POST WAR POSSIBILITIES

By Paul M. Raigorodsky

Vice President, Petroleum Engineering, Inc.

PRE-WAR activity of the natural gasoline industry was, in general, restricted to the operation of relatively small plants processing casinghead gas for the recovery of the natural gasoline and liquefied petroleum gases. With the advent of deeper drilling and the discovery of the so-called "condensate sands", a remarkable growth has occurred in that section of the natural gasoline industry which is appropriately referred to as "cycling operations". The modern cycling plant effects the removal of the desirable hydrocarbon fractions and returns the dry gas to the same sand from which it was withdrawn. Thus the natural gasoline industry, in addition to processing casinghead gas, has expanded its field to "cycling operation". The cycling plant separates and recovers valuable hydrocarbons and may also process these into finished products, assuring increased recovery from deep petroleum deposits.

War time has found the greatest of all technologic developments occurring in the petroleum industry. These developments have not been confined to the processing of crude oil but find even greater application when natural gasoline and its derivatives are the initial raw materials. Decreasing discoveries of crude reserves, shortage of critical material and transportation difficulties, combined with modern processes, have brought recognition of the great value of natural gasoline and its derivatives. Natural gasoline has taken its place in the front rank of petroleum products fighting the war. Certain of these factors, of importance in war time, will carry over with perhaps even greater force in the post war period and will have profound effect on the present natural gasoline industry.

Under current conditions the post war posibilities of the natural gasoline industry resolve themselves into two parts: (1) Post war possibilities of "natural gasoline plants" and (2) Post war possibilities of "cycling plants".

In the post war period, I believe, only a few natural gasoline plants will be built as such. This condition will be brought about by rigid conservation measures, resulting from decreased crude reserves in the United States. The production of crude oil in the future will be from wells with greater spacing than heretofore. To effect maximum recoveries, pressure maintenance will be enforced. Natural gasoline operations will become an integral part of the crude production program and not merely a by-product recovery project. These conditions suggest that the natural gasoline plant in the post war period will have as its prime function the recovery of additional petroleum fractions, crude and otherwise; and under these circumstances, it should become the function of the natural gasoline manufacturer to supply the essential additional services. Unquestionably the natural gasoline manufacturer could offer the best possible medium for bringing together all the interests in this new situation.

The post war period will find a great increase in the number of cycling plants. A recent check of new discoveries shows that approximately 75 percent of new reserves are of the "condensate type" and of substantial magnitude. A plant to process from 100 to 300 million cubic feet of gas daily will not be unusual. Unitization or consolidation of operation will become a term of increasing importance because the complexing phenomena of retrograde condensation requires the processing of the "condensate sand" as a unit. Such operations can only be effected on a practical and economic basis under a program of unitization or consolidation of leases.

The operation of cycling plants in most cases will be in the hands of those companies directly concerned with producing operations in the field due to the close relation between the cycling and the production program. If one or more of the producers is also a transporter and refiner of petroleum, products of cycling operations through refinery channels will be available and much of the present disinclination to use condensate, natural gasoline and its derivatives will be minimized or eliminated. The dove-tailing of cycling and refinery operations will bring forcefully to the attention of the petroleum industry the value and the desirability of using "field plants" for the production of chemical raw materials and finished products, chief of which may become aviation fuel.

Use of "field plants" for the production of chemical raw materials and finished products will allow greater economies in overall operations. Current conditions have accelerated and in some cases have forced some of these developments upon the petroleum industry, but the post war period will see ever increasing developments in this field.

In the post war period the production of synthetic goods not only will continue but will increase. War time conditions have insured the development of processes in which natural gasoline derivatives may be reformed into chemical raw materials. The most important of these raw materials will be acetylene, ethylene, and propylene. These materials may be the starting point for the production of the super glass, Lucite and Plexiglas, superior synthetic rubbers, Vinyon synthetic fibers, Saron, and others. These synthetic products will tend to replace natural products to such extent, particularly metal materials, that the source of the raw material for their manufacture must be carefully considered. Controlled oxidation of natural gas yields aldehydes and alcohols. In addition to methanol, the post war period should see immense quantities of ethyl alcohol manufactured from natural gas. Formaldehyde, which is of fundamental importance in the production of the majority of molded plastics, will be one of the outstanding chemical raw materials derived from natural hydrocarbons. These developments will be dependent upon the availability of large quantities of light hydrocarbons and the difficulty encountered in their transportation, due to their physical properties, insures the use of "field plants" in the post war petroleum and chemical industries.

In the post war period the natural gasoline industry should have new and increased demands for its products in outlets to the gas industry. During this period developments in house heating and cooling, together with increased demands for distributed gas, will tax existing distribution systems. The manufactured gas industry of today finds itself face to face with a grave condition because large cities are rapidly nearing the capacity of their distribution systems. Constant pressure requirement, together with intricate design of distribution systems, makes installation of increased capacity possible, if at all, only at great expense. One answer to this problem which has been adopted by some leading gas companies is the conversion to higher BTU gas. The manufacture of gas in excess of 550 BTU per cubic foot in the absence of cold enrichment is not economical in present day manufacturing sets. Higher BTU content of manufactured gas will be obtained economically and practically by the use of natural and liquefied petroleum gas. In addition, such additives would substantially improve the quality of the resultant mixture.

Development of new processes is continuous. In addition modern methods of chemical analysis will replace the old and cumbersome methods which made efficient plant control difficult. In some cases new processes will eliminate the necessity of separation of light hydrocarbons from gas. These conditions will have a great effect upon the natural gasoline and cycling industries in the post war period and will result in many adjustments.

The natural gasoline industry has grown until it now is entering upon a new and outstanding phase of its relationship to the petroleum industry as a whole. To survive and grow, natural gasoline operations must be expanded to cover fields other than that of strictly hydrocarbon recovery and separation. The natural gasoline industry must face these facts and prepare to make the required adjustments so that the valuable service it now renders the country in war time will be continued in the post war period.

SHELL'S WOOD RIVER REFINERY TODAY

A Modern Plant Integrated to Produce All Refined Petroleum Products For Civilian and Military Use.

THE final day of April witnessed the formal dedication of Shell Oil Company's new fluid catalyst cracking plant at the Wood River refinery in Illinois. The occasion was taken to make a celebration of the tenth anniversary of the delivery of the first 1000 gallons of 100-octane aviation gasoline, with which the United States Army began its experiments with this super-fuel that at the present moment is furnishing power for aerial warfare on an unprecedented scale. The technique of the manufacture of 100-octane fuel was largely developed by Shell technologists at Wood River, and historically was marked by the following stages:

1934:—The process of cold acid polymerization of butylene and hydrogenation of the product to iso-octane; this lowered the cost from $25.00 to $2.00 per gallon.

1936:—Introduction of the hot acid polymerization process, which doubled the yield and still further reduced cost.

1939:—Adaptation and introduction into petroleum chemistry of the classic sulfuric acid alkylation process, by which iso-octane is produced in a single step; production was thereby increased ten-fold and the price of 100-octane fuel was brought within the range of practical consideration.

1941:—The process of butane isomerization, by which normal butane is transformed into iso-butane. This very greatly increased the supply of isobutane which is essential for the manufacture of aviation alkylate, the basis of 100-octane fuel.

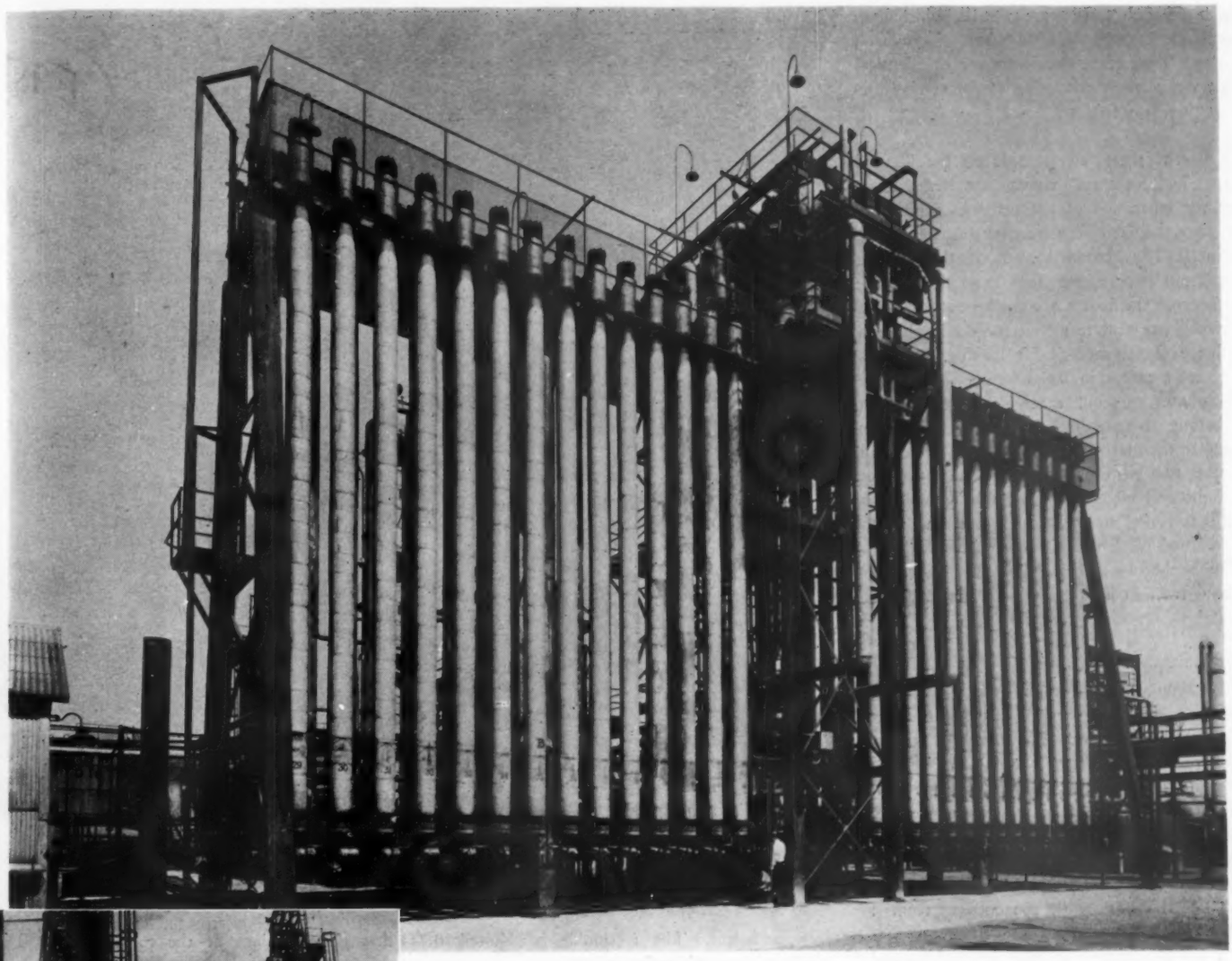
1942:—Utilization of cumene as an ingredient or blending agent in 100-octane fuel; acquisition of this new agent increased the supply of aviation fuel by as much as 22 per cent.

1943:—Isomerization of normal pentane to iso-pentane (analogous to the isomerization of normal butane to iso-butane); this made possible another great increase of the supply of materials from which to compound 100-octane fuel.

The upshot of these successive advances in technology is that the petroleum refineries of the United Nations are now producing 100-octane aviation gasoline at the rate of 400,000 barrels (16,800,000 gallons) a day.

Toluene Unit of Shell's Wood River, Ill. Refinery.

Opening "100-Octane Week" Under Secretary of War Robert P. Patterson, Mrs. James H. Doolittle (Wife of Lieut. General Jimmy Doolittle) and Alexander Fraser President of the Shell Oil Company, Inc., Unveil the Monument Above a "Time-Capsule".



A Section of the Cumene Plant. Here in These Fifty-six 40-Foot High Pressure Reaction Tubes, Propylene and Benzene are Alkylated to Make Cumene.

Giant Cracking Vessels. Size of This Huge Unit is Indicated by the Figure of the Man on the Catwalk.

Even so, the rate of production is still rising as new installations for catalytic cracking are completed and brought into production. What the ultimate daily rate of production will be is not disclosed; in this connection it is interesting to recall that in March 1941, the Army aviation experts estimated that the daily wartime requirement for 100-octane gasoline would not exceed 24,000 gallons.

Although the production of 100-octane gasoline is a vitally necessary function of wartime petroleum refineries, it represents only a relatively small proportion of the total volume of products —about 15 per cent. The rest is accounted for by products that perform other equally necessary if less spectacular functions—lubricants, diesel oil, heating oils, and the motor gasoline necessary for maintaining essential civilian transportation.

The supply of crude petroleum is none too plentiful in relation to needs, and the task of the wartime refinery technologist is to integrate his operations so as to make the most advantageous possible use of the great variety of secondary products that come under his hand. A particular object at the present time is to manipulate each separate process so as to obtain a maximum contribution by that process to the stock of materials suitable for compounding 100-octane gasoline.

The Wood River refinery has carried this integration to considerable lengths, and in this respect may be regarded as a typical example of American oil refining in all the multitudinous branches of this art.

As in all large refineries, operations at Wood River are based on both thermal and catalytic cracking processes, each being used to supplement or complement the other. This dovetailing of the two processes and their products is responsible for a great number of operational units and miles of piping.

At Wood River operations on the crude petro-

leum begin with three topping stills, which have a combined capacity of 85,000 bbl. of crude oil per day. Two of these towers are of identical design and have fractionating equipment consisting of three towers.

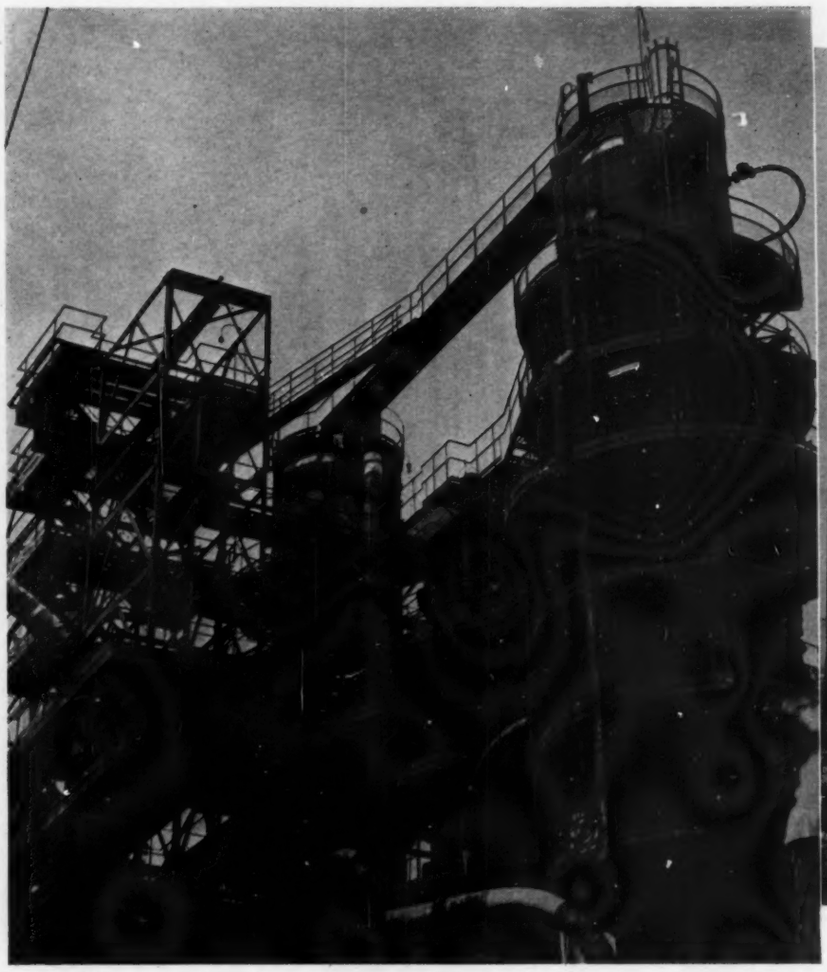
The first of these towers takes off the C_6 and lighter hydrocarbons, which are sent to a plant for separation of the pentanes which are now very valuable constituents of 100-octane gasoline. The second towers of the topping units begin where the first ones leave off; they remove the hydrocarbons between C_6 and C_{10}, which are sent to a unit for the production of toluene that is needed for making explosives and to some extent in 100-octane gasoline. The third column cuts out the hydrocarbons within the boiling range 300°-400° F., which are charged to thermal reforming units. This column also takes two gas oil fractions, one that qualifies as a light fuel oil and another that is added to stock that is fed to the catalyst cracking units. The residual oil from this tower is flashed into old Dubbs thermal cracking units, from which an overhead fraction is taken as additional material for catalytic cracking.

The remaining unit of the three topping units is a combination of a primary and a secondary atmospheric tower, a vacuum distillation tower and three fractionators. The overhead stream of the primary atmospheric tower (225° F. end point material) goes to the first of the three fractionating towers attached to this unit, which functions as a dehexanizer. Bottoms from the primary tower supply the secondary atmospheric tower, the overhead of which feeds the other two columns of this unit while the bottoms from it feed the vacuum distillation unit. This unit produces a gas oil charge for catalytic cracking and other fractions for lubricants and asphalt.

The dehexanizing tower attached to this topping unit delivers an overhead that constitutes an additional supply to the pentanes plant, and a bottoms that, after passing the next two fractionators, is resolved into the well known line of organic solvents for rubber, paints and varnishes which is a specialty of this refinery.

On arrival at the pentanes unit the light end material produced as overhead in the topping units are handled to produce isopentane and isohexane and other hydrocarbons for use as components of aviation gasoline. The pentanes unit comprises four towers operating in series. The first is a debutanizer, the second a depentanizer, the third a deisopentanizer and the fouth is another debutanizer.

The first debutanizer has the function of removing the C_4 and lighter from the light ends delivered by the topping units, and of supplying a concentrate of C_5 and C_6 to the depentanizer, which in turn separates the pentanes from the hexanes. Then the normal and isopentane components of the C_5 fraction are separated in the deisopentanizer. The n-pentane is shunted to motor gasoline, while the more valuable isopentane is treated in the second debutanizer to remove the remainder of C_4.



A Study in Mass and Height — Distillation Section of the Catalytic Cracking Units.

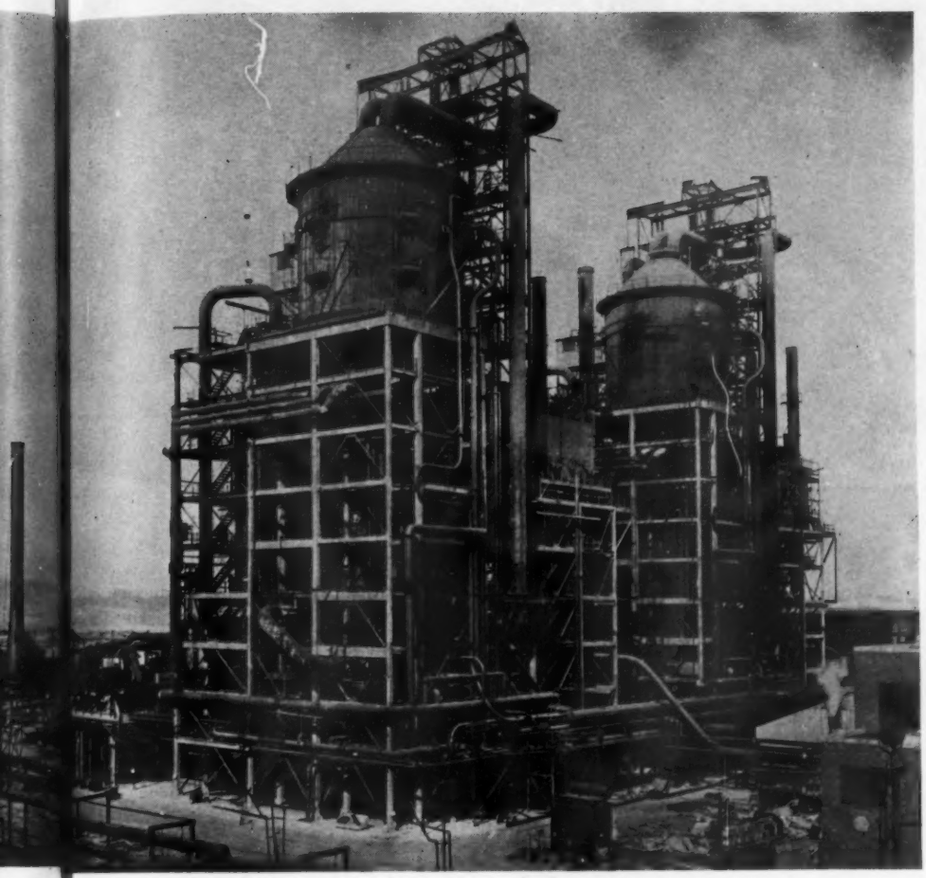
In the meantime the twin fluid catalytic cracking units of the Wood River refinery go to work on material provided for it by the crude topping system. This material consists of mixed gas oil cuts which go to one of the "cat" crackers, while the other takes residual stock. As stated above the heavy residue from the two identical topping units is flashed into a converted Dubbs thermal cracking installation.

The two cat cracking units have a combined capacity for charging 31,000 bbl. a day, and are of the improved bottom draw off type. Products of the catalytic cracking operation include aviation gasoline base stock, low cold-test distillate fuel oil, and a heavy gas oil. The latter is sent to thermal cracking. The base stock is subjected to a special hydrogenation treatment, from which it issues practically free of sulfur, with an improved susceptibility to TEL, with a lower olefin content, and consequently a better stability, a higher content of aromatic and a higher octane rating. The hydrogen for treating the base stock is obtained through operations at the toluene unit. This treatment of the base stock yields some more pentane, which goes to the pentanes unit.

Besides the liquid products herein mentioned both the thermal and the catalytic cracking departments produce a large amount of the lighter gases (C_2 and under) which also entrain noteworthy amounts of other components up to C_6.

Each of the cracking systems has its own separate gas recovery system. Gases from the thermal units first enter a high-pressure oil-absorption tower, which permits methane and ethane to pass while retaining those hydrocarbons of greater refinery interest. On their way to be burned in the refinery furnaces the methane and ethane pass through gas turbines which convert their high pressure into useful power.

The "fat" oil which accumulates in the absorber is flashed into a fractionator; the overhead from this unit is combined with light ends coming from the thermal cracking and reforming unit stabilizers, and the mixture is further treated to depropanizing and debutanizing operations. The overhead from the depropanizer is further treated to remove accompanying ethane, while the heavier material is sent to a debutanizer for obtaining



New Twin Fluid Catalytic Crackers. These 203-Foot Stacks are Key Units in the Production of 100-Octane Gasoline.

C_4 material for the alkylation unit, and C_3 and higher is mostly shunted to the motor gasoline department.

The gas recovery systems attached to the catalytic cracking department operate in a generally similar manner. The gases are compressed into a high-pressure oil absorber which delivers dry gas to the refinery fuel system. The absorbed gases, plus similar light ends from the stabilizers are depropanized and debutanized as before; the C_5 contained in the bottoms from this operation is treated as alkylation stock; the C_6 (mostly isohexane) is blended with the aviation base stock. The fraction C_3 and lighter from both cracking systems is deethanized and the propane C_3, thus obtained is used to provide propylene for the cumene unit.

The Wood River alkylation units, of which there are several, have a combined capacity for producing 5,000 bbl./day of alkylate by the hot sulfuric acid process. The charge for the alkylation units is a mixture of the C_4 cuts that are collected from the debutanizers attached to the topping units and some from the isomerization unit, and the butylenes that originate during the thermal and the catalytic cracking processes. This mixed feed is sent through the reaction vessels containing the sulfuric acid catalyst. After a wash with caustic soda the product is fractionated; in this fractionating operation the crude alkylate is debutanized, and the excess of unreacted isobutane is returned to the alkylation cycle. Debutanizing is followed by depentanizing, which furnishes more feed to the pentanes plant, after which the depentanized alkylate is rerun. The final residium of this series of fractionations is consigned to motor gasoline.

One of the bottlenecks in the first stages of the aviation gasoline program was the scarcity of isobutane. Previously, the supply of this essential material for alkylation was limited to the isobutane contained in natural gasoline and in the light ends from the crude topping units.

This shortage is now met by producing "artificial" isobutane by isomerizing normal butane, of which there is an abundance—even an excess—in both crude oil and natural gasoline. The butane, previously separated from any accompanying isobutane in the deisobutanizing columns, is purified, dried, and mixed in definite proportions with anhydrous hydrochloric acid, aluminium chloride as the catalyst, and a catalyst solvent. After the reaction the isobutane that has been produced is purified and sent to the alkylation department and the catalyst materials are recovered for repeated use.

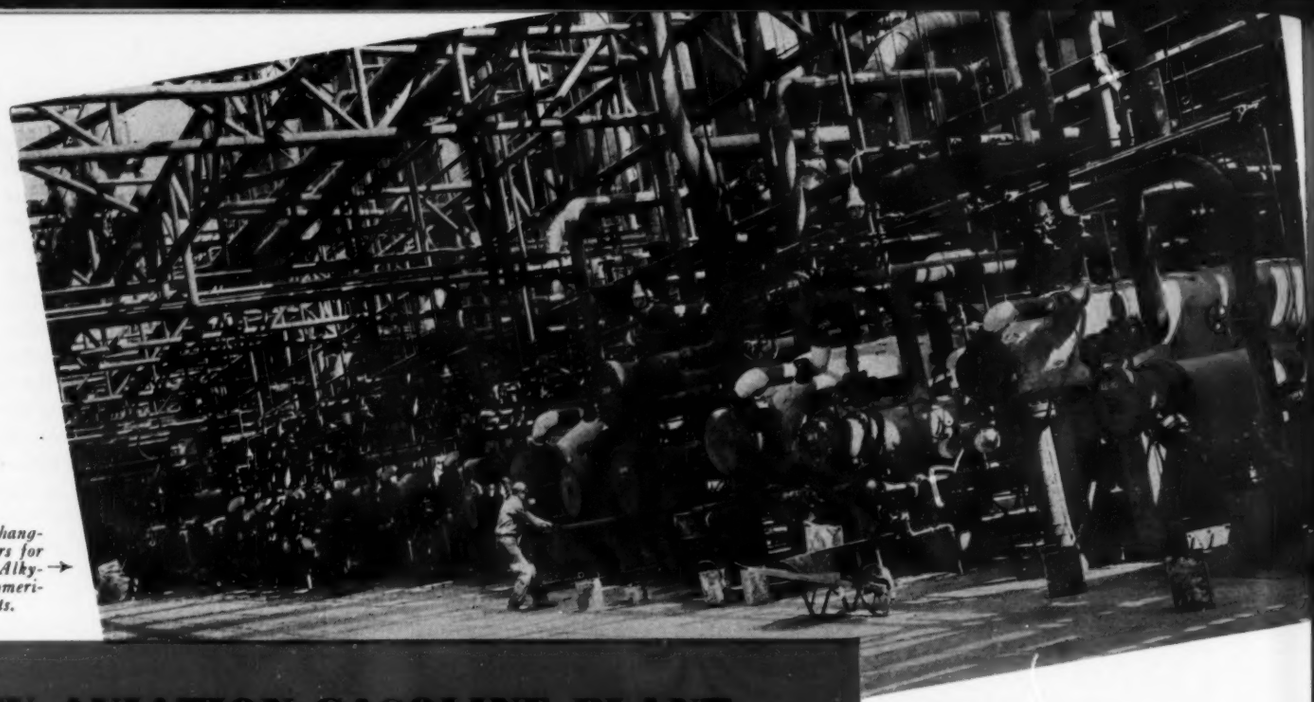
It may be recalled that 100-octane gasoline is any mixture of gasoline hydrocarbons to which a rating of 100-octanes can be assigned by the official testing methods now in use. What materials are put into the mixture is of no consequence if the final product meets the specifications. In the earlier stages of the industry a satisfactory product could be made by taking an aviation base stock obtained from catalytically cracked gasoline, adding iso-octane produced by alkylating isobutane with butylene, along with isopentane and some TEL. But the 100-octane fuel produced in this manner is not the last word in aeronautic power. It has been found that there are even better anti-knock agents than isopentane and the iso-octane produced by alkylation. These superior agents are aromatic hydrocarbons, in which catalytically cracked gasoline is especially rich. And some aromatic hydrocarbons are better than others. Among the best is cumene or isopropylbenzene, which is manufactured at Wood River in a special cumene plant.

Cumene is made by taking the propane that comes from the deethanizing columns that treat the light gases from thermal and catalytic cracking operations, dehydrogenating it to produce propylene, mixing the propylene with benzene (obtained from an outside source), and then subjecting the mixture to a catalytic alkylation process. After separating the unreacted propylene and benzene for return to the cycle and rerunning the crude cumene, the purified product is ready for mixing with the other ingredients of aviation super-fuel.

A relatively minor source of additional aviation gasoline components is obtained from Wood River's toluene plant, the principal function of which is to obtain toluene for the explosive TNT. The feed for the toluene plant is the cut of C_6 to C_{10} fraction from one of the crude oil topping units. This charge is prefractionated to remove the higher boiling fraction, which after further treatment is included in the aviation gasoline.

The remainder is fractionated into two cuts, one of which is isomerized to produce methylcyclohexane, which upon dehydrogenation yields a toluene concentrate from which, after a somewhat elaborate purification treatment, toluene of nitration grade is finally obtained.

The foregoing particulars, which necessarily omit mention of a great many auxiliary items, show how the operations of a great modern petroleum refinery are coordinated and integrated into a harmonious whole, and so combined as to put the greatest emphasis on production of aviation gasoline, for which there is the greatest present need, while at the same time producing all the other no less indispensable hydrocarbon materials, with a maximum of efficiency and a minimum of waste in each case. By attention to these principles of coordination and integration the Wood River refinery is in a position to raise its production of 100-octane gasoline close to 25 volume percent of the total run of crude oil.



Reboilers, Exchangers and Coolers for Fractionating, Alkylation and Isomerization Units. →

NEW AVIATION GASOLINE PLANT IN OKLAHOMA

DURING the past month Oklahoma joined the list of states producing military aviation fuel when Continental Oil Company's 100-octane number aviation gasoline plant went into operation.

This plant is a complete self-contained project for the production of blended aviation gasoline to meet Army and Navy specifications. The various components entering into the final blend of 100-octane aviation gasoline will be manufactured in the new facilities from raw feed stocks available from the refinery. These feed stocks consist primarily of gas oil produced from refinery topping operations, a quantity of blending components fractionated and extracted from hydroformate available in the refinery, and from butane-butylenes from the refinery thermal cracking and topping operations.

The blending components entering into finished aviation gasoline in this plant are produced in two standard size Thermofor catalytic cracking units, one standard Thermofor catalytic cracking retreating unit, a hydrofluoric acid alkylation unit, and an aluminum chloride isomerization process installed by The Lummus Company. In addition to the main processes, the plant is self-contained as to storage tanks, blending facilities, high pressure steam boilers, and induced draft cooling tower facilities.

Existing facilities in Continental's Ponca City refinery will be used for the production of the raw feed stock and the reprocessing of cycle and by-product stocks from the new aviation gasoline facilities, thus permitting Continental to make its full contribution toward the production of the maximum possible quantity of 100-octane aviation gasoline for the national defense needs.

The two Thermofor catalytic cracking units work on a 1 to 1 recycle cracking operation on gas oil. The wet gas and distillate or gasoline produced from this operation are pumped and compressed to high pressure for further processing through a feed preparation unit. Various specification cuts of distillate may be produced as by-products from the catalytic cracking units.

The debutanized distillate or gasoline from the cracking operation is then reprocessed through the catalytic retreating unit for the production of specification aviation gasoline base stock. The gasoline and wet gas produced from the retreating unit, which are produced at substantially atmospheric pressure are pumped and compressed to high pressure for further processing through a separate feed preparation unit from that used to stabilize and recover gasoline from the cracking operation.

In the combined feed preparation unit, the gasoline produced is completely debutanized, and the wet gases are substantially completely stripped of all butane components. After combining with butane-butylenes recovered from the main refinery operations or purchased from outside sources the butane-butylenes available in the refinery are processed through a hydrofluoric acid alkylation unit operated in conjunction with an aluminum chloride isomerization plant for the production of aviation alkylate. The isomerization unit is

operated to convert normal butane into isobutane, an essential component for the production of alkylate or iso-octane. Isobutane in the presence of hydrofluoric acid as a catalyst is joined together with butylenes or may be joined with propylenes or amylenes for the production of aviation gasoline blending components known as alkylate. While this plant is primarily designed for the production of alkylate from butylenes, any available capacity of the plant will be utilized in alkylation of propylenes and amylenes for the production of the maximum quantity of alkylate.

As previously stated, by-products from the combined aviation gasoline plant operations will be returned to the main refinery for disposal or for further processing through thermal cracking equipment, thus producing additional butane-butylenes to increase the output of ultimate aviation gasoline.

Since sulfur compounds are extremely detrimental to the quality of aviation gasoline, all butane-butylenes entering the alkylation and isomerization units are previously passed through a two-stage caustic treating system for the removal of hydrogen sulfide and mercaptan sulfurs and thence through a clay drying system to remove the last traces of water present in this stock before being contacted with the acids used for catalyst in the alkylation and isomerization units.

The two basic aviation gasoline components — alkylate and Thermofor catalytic retreated base stock — are then brought together in blending tanks equipped with agitators in the proper proportions to meet aviation gasoline specifications. Isopentane, another blending component for control of vapor pressure, may be produced from the operations as a separate component or left in the base gasoline, as desired. To this blend of components tetraethyl lead is added for maximum octane value.

The above two basic components may be augmented by facilities available in this new plant for increasing the volume by the use of CS blending components, additional lower grade marginal base gasoline (generally extracted direct from crude, or fractionated as components of available refinery hydroformate), and various aromatic compounds including toluene for increasing rich mixture octane and performance value.

Facilities of this plant have been so arranged that a large quantity of the daily production may be rapidly moved by tank truck or the entire plant output moved by tank car to meet the demands and needs of the Army and Navy.

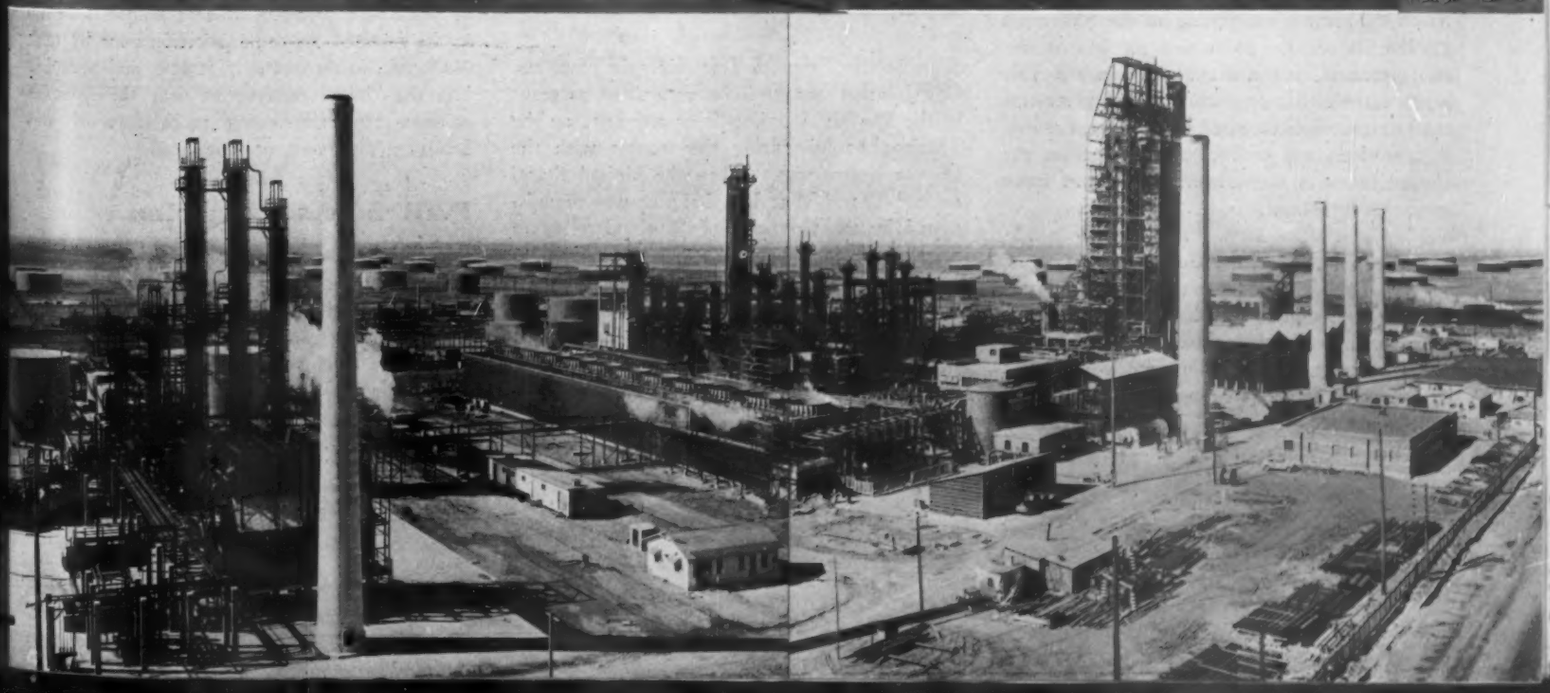
Most of the steam required for reboilers and prime movers in this plant is generated at 450 pounds. Three 75,000-pound per hour high-pressure boilers are augmented with high-pressure steam produced from the Thermofor catalytic cracking units. A part of this high-pressure steam is utilized at the higher temperature level for reboiler services and the remainder of the requirements is expanded through turbines to 150 and 25-pound systems for smaller pumping units and for lower temperature level reboiler requirements.

The cooling water required for the operation of this plant is maintained from a 30,000 gallon per minute induced draft cooling tower system.

Right: Compressors Serving T.C.C. Cracking and Retreating Units. →

Lower Left: Pump Room, Toluene Extraction Unit. ↙

Octane Aviation Gasoline Plant (Center and Right) at Ponca City. Toluene Plant at Left. ↓



★ ★ ECHOES FROM THE WASHINGTON OIL FRONT ★ ★

By **W. J. Maddox,** Chief of World Petroleum's Washington Bureau

Canol Agreement Revised

Robert W. Patterson

ARMY'S confidence in the possibilities of its much-criticized Canol project in Northwestern Canada still runs high, and, if anything, appears to be mounting. A new agreement with the Canadian government and Imperial Oil slashes the crude price to the United States to 20 cents a barrel, plus production costs. Army says this was possible because "the oil reserves having proved to be greater than first thought, the early exploration and development costs can now be met by sale of a larger quantity of oil at a lower price."

"In addition to the use of petroleum products during the present war," explained Under Secretary of War Patterson, "the new agreement is fundamentally a matter of insurance that in the future the defense of the Continent will not be endangered as it was early in 1942 by lack of locally produced oil in the Northwest."

Army has suspended its exploration for additional oil reserves in the Canadian Northwest. Under the new arrangement this will be continued by Imperial. In addition, the Jersey Standard subsidiary will go ahead with development of the proven Norman Wells field so as to have an assured supply of crude up to 4,000 barrels a day for the Army's refinery at Whitehorse, which began operations April 30. Rewriting of the agreement may bring repercussions from socialist members of the Canadian Parliament.

High Octane Needs Grow

ACCORDING to Under Secretary of War Patterson the army is not getting all the 100-octane gasoline its needs — production for March was 96 percent of estimated requirements and July is the earliest that production and requirements can be expected to balance. The pinch, of course, is applied in use of the precious fuel in the United States as requirements in the war zones are met 100 percent.

The result is that the Air Corps is forced to use 91-octane gasoline for operational combat training, the final tune-up the fliers get before being sent aboard to take their places on the firing line. Patterson points out that pilots and crews should do this part of their training under exactly the same conditions as they will have in actual combat, using 100-octane fuel.

There's an "if" in his expectation that requirements ought to be met in July, and that is, unless the consumption line crosses the estimated requirements point. The construction program is not up to schedule, and the reasons are labor, materials and synthetic rubber requirements.

Outlook for Materials

PROSPECTS appear none too bright that restrictions on materials for petroleum operations will be modified "at a faster rate than they have been lifted so far this year," judging from PAW Director of Materials Claude Parsons's May report. He says there are no indications at present that raw materials are sufficiently easy to warrant an easing up. On the contrary, he holds out the possibility that "we may have to increase restrictions" if materials become tighter due to manpower shortages and critical changes in military requirements. He believes, however, that sufficient materials can be made available for the presently proposed petroleum production program in the third quarter.

Johnson Heads ODT

Col. J. Monroe Johnson

TOUGH-FIBERED, virile and active Col. J. Monroe Johnson of South Carolina has succeeded to the post of director of the Office of Defense Transportation left vacant by the untimely death of Joseph B. Eastman who had held the position since it was established. Col. Johnson has been a member of the Interstate Commerce Commission since 1940 and has behind him a long record of engineering and military experience.

Born in the Palmetto State sixty-six years ago Col. Johnson saw service as an artillery sergeant in the Spanish American War and later on the Mexican border during the trouble with the Huerta government. When the United States entered World War I in 1917 he was commissioned by the Governor of South Carolina to raise a battalion of engineers which was sent to France as part of the Rainbow Division and participated in the actions that gave that Division its fame. In the course of this service he received successive promotions emerging from the war with the rank of Colonel.

In the course of his practice as a civil engineer at Marion, S. C., Col. Johnson gave special attention to bridge and highway construction and he served as chairman of the South Carolina Highway Commission prior to his appointment to the Interstate Commerce Commission.

Army's Can Making Plants

Brig. Gen. Peckham

NOW that more tankers are available, Brig. Gen. Howard L. Peckham's Fuels and Lubricants Division, Quartermaster Corps, is moving petroleum products overseas for the most part in bulk instead of in 55-gallon drums or 5-gallon "blitz" cans. This method is less expensive and at the same time conserves "dry" shipping for moving other war necessities.

Another reason for the more economical shipment in bulk is that packaging facilities have been provided in various theatres of operations. In the United Kingdom, can manufacturing plants now are furnishing all the containers needed for local use and are being supplied with flat steel by the Army through lend-lease. Also, the United States Army has set up five plants for making containers in the Middle East. These plants were fabricated in the U. S. The Army further is cooperating with the British in using six can plants in India, owned and operated by the oil companies in that area, for whom the Allies are the sole customers. Additional Army-owned plants are now in process of construction for use in other localities.

The new policy permits the less costly shipment of petroleum products, their transportation up to the front of the communication zone by tank car, truck, in tankers or pipe line, and pumping into the "blitz" cans up as near the front as possible, thus eliminating much forward and backward movement of containers.

PAW Seeks Expansion

ALTHOUGH war plant construction has passed its peak the Petroleum Administration for War feels that it will need more money and an enlarged working force to carry on its operations during the fiscal year beginning July 1st next. The estimated increase in personnel for the Washington headquarters is 120 but some slight reductions are contemplated in district office

staffs. Approximately half a million dollars more money is being asked for, which places PAW among the very modest members of the capital bureaucratic group. Significantly, perhaps, the projected expansion in the PAW working staff is largely in the foreign sections which now include separate divisions on foreign production, foreign refining and foreign supply and distribution. It is calculated that 38 more persons will be required to take care of the increased activities of these sections while 42 are to be added to the general refining division.

Navy to Drill in Alaska

NAVY'S plans to pursue exploration of its Point Barrow reserve in Alaska now have the tangible support of a $1,000,000 grant included in the Naval appropriation bill appropriating $32,000,000,000 which received Congressional approval last month. According to the information given to the Committee it is the intention of the Navy to drill six test wells in this reserve which comprises about 35,000 square miles on the Arctic coast of Alaska. It is intended to use Seabee personnel on this work.

Labor Board Conflict

James Tanham

IT just happened that the sharp clash between industry member James Tanham, vice president of Texas Company, and War Labor Board Chairman Davis was over a decision involving an oil company—Humble Oil and Refining Company, Ingleside, Texas—and Local 316, Oil Workers' International Union, CIO. All the industry members of the board dissented, with Tanham carrying the ball.

The board's decision, which reversed a previous one of the regional board at Dallas, involves a subtle point but it is far-reaching in that it means a shift in policy in granting unions "maintenance of membership." Heretofore it has been up to the union to prove it needed the "maintenance of membership" clause in the agreement to protect it from the company. Now the burden of proof is on the company to show that the union is irresponsible and should not have the benefit of the clause.

Henceforth, "maintenance of membership" will be asked for in every dispute. All the union has to do now to get it is to come in with clean hands. Tanham and the rest of the industry members balked at this, and in the first draft of his dissenting opinion Tanham touched Davis on a very tender spot by inviting court action to see if the board really has authority to impose its form of "maintenance of membership." Tanham toned this down to a statement that a judicial determination would be "welcome."

Navy Salutes High Octane

Aboard Navy Transport Plane J. Howard Pew

ONE of the features of 100-octane week, the first week of May, was an air show put on by the Navy for the edification of a group of about thirty prominent oil company officials, representatives of PAW and Naval officers aboard an aircraft carrier off the Virginia coast. The party traveled from Washington to the Norfolk Naval base aboard one of the Navy's big transport planes. From there they were conveyed to the carrier by speedy crash boats and after an inspection tour of the ship witnessed from its flight deck a series of operations simulating actual combat conditions.

These included take-offs and landings by the carrier's planes, a torpedo bombing and strafing attack and a salute from a squadron of torpedo bombers that passed over the ship in battle formation.

Paying tribute to the value of 100-octane fuel to the Navy Vice Admiral Moreell, Chief of the Bureau of Yards and Docks said:

"Having been a member of a committee vitally interested in the construction of new facilities for producing '100-Octane Gasoline", I have come to appreciate the tremendous significance of this fuel in our war effort. Only 10 octane numbers on the rating scale for gasolines distinguish this fuel from the average prewar aviation gasoline; however, it is these few numbers that represent the extra for our big bombers, the extra speed for our fighters, and the extra men in our large transports. They also mean extra sacks of mail for the morale of our fighting men throughout the world. All of these contribute to those 'extra days sooner' that the war will be over, saving thousands of American lives to return to their homes and loved ones."

Brooks Succeeds Zwerneman

WILLIAM C. BROOKS, who recently joined the PAW Materials Division as special assistant to the Director of Materials, fills the vacancy which was created by the departure of Alvin Zwerneman whose resignation became effective April 1. Mr. Brooks will be in charge of the CMP-4B Section of the Materials Division, which is responsible for allotments of controlled materials to the more than 400 petroleum equipment manufacturers who report to PAW as their claimant agency and industry division. During the second quarter of 1944, the petroleum equipment manufacturers will acquire 68,685 tons of carbon steel, 35,000 tons of alloy steel, and 1,560,000 pounds of copper and copper base alloy with which they will manufacture oil well drilling machinery and oil producing equipment for use by both domestic and foreign petroleum operators who look to the petroleum equipment manufacturers of this country as their only wartime source of supply for this material.

For the past four years, Mr. Brooks has been assistant to the president of the Petroleum Equipment Company of Los Angeles. Before that he was employed for 23 years by the Standard Oil Company of California. He rose from an oil field laborer after World War I to purchasing agent of the Los Angeles district of the company. He resigned this post to join the Petroleum Equipment Company.

Mr. Zwerneman returns to the Axelson Manufacturing Company to resume his duties as vice president of that company. He was granted leave of absence July 1, 1943, to accept the position with the Materials Division of PAW.

Robinson Heads Public Relations

Spencer W. Robinson

SPENCER W. ROBINSON, the new director of public relations for PAW, brings to the job plenty of experience in oil and journalism. For twenty-five years years he was associated with the Gulf Publishing Company of Houston, Texas, and "came through" all the important booms during that time in the Southwest area from Goose Creek to and including the Seminole Field and Oklahoma City. He succeeds Gordon Sessions who has taken over the job of directing public relations for the Petroleum Reserves Corporation.

Mr. Robinson's background in oil goes back even to high school days when he worked in a Texas refinery laboratory. Most of his experience with the publishing company was in the editorial department, but for four years he served as sales manager. In 1920 he opened the company's Tulsa office. At the time he left to go with PAW he was vice president and editorial director. Also, he was a member of the Houston city council.

Mr. Robinson says editorial duties left him little time for golf, but he is known to be a keen horseman and likes hunting, particularly deer and wild turkey. He is married, and has two daughters.

Oil Company Staff Changes

R. V. LeSueur

R. V. LeSueur, K.C., has been elected president of Imperial Oil Limited, succeeding G. Harrison Smith, president of the company since 1933, who becomes chairman of the board. George L. Stewart, general manager of the company's refineries, has been named vice-president in charge of manufacturing, succeeding L. C. McCloskey who has retired after 41 years of service. Other vice-presidents are C. A. Eames and H. H. Hewetson. Directors of the company elected by the shareholders for the current year are: G. Harrison Smith, R. V. LeSueur, H. H. Hewetson, George L. Stewart, A. E. Halverson and F. W. Pierce.

Imperial's new president is a native of Sarnia and a graduate of the University of Toronto and Osgoode Hall. For several years he practised law in Sarnia as a partner of the late Hon. W. J. Hanna, and from 1921 to 1925 he represented West Lambton in the House of Commons. In 1926 he became a director of International Petroleum Co., Ltd., and was largely responsible for the great development of that company's producing, refining and marketing activities in South America. In 1933 he was made a vice-president of International Petroleum and in the same year was elected to the board of Imperial Oil and made a vice-president of that company.

G. Harrison Smith began his career in the oil business as a boy in 1898 and held various positions in the accounting and sales departments. In 1911 he was elected vice-president of the West India Oil Company, and was also engaged in an executive capacity in connection with the export and sale of petroleum products in Brazil. In 1914 he resigned these positions to become vice-president of Imperial Oil Limited and vice-president of International Petroleum Co., Limited. He was elected president of International Petroleum in 1917, and in 1933 was elected president of Imperial Oil Limited.

Mr. Smith's transfer to chairmanship of the board, which was made at his own request, relieves him of some of the great burden of responsibility which he has carried for the past twelve years while allowing him to retain his active interest in the company's operations.

W. S. S. Rodgers, president of the Texas Company since 1933, was elected chairman of the of Directors following the annual stockholders' meeting at the end of April. Mr. Rodgers remains as chief executive officer of the company. At the same time it was announced that Harry T. Klein, executive vice president and general counsel, has been elected president of the company. R. L. Saunders, secretary, was elected a vice president in addition to his duties as secretary. O. J. Dorwin, former associate general counsel, was elected general counsel.

Both Mr. Rodgers and Colonel Klein have been associated with The Texas Company for many years. Mr. Rodgers, a native of Columbus, Ohio, was graduated from Sheffield Scientific School, Yale University, in 1907, and entered the service of The Texas Company in November, 1915. During World War I he served in the United States Army, and was honorably discharged with the rank of Captain. Returning to The Texas Company, he held various positions in the refining department until 1926, when he was appointed assistant to the president. He was elected vice president in charge of domestic sales in October, 1928, and became a director in November of that year. In 1929 he was made a member of the executive committee, and was elected president in 1933.

Colonel Klein was born in Bellevue, Campbell County, Kentucky, and from 1907 to 1917 he practiced and taught law in Cincinnati. In August, 1917, he was sent to France as a First Lieutenant and served with the 28th Infantry, First Division. He was the first Major Judge Advocate appointed in France. In September, 1918, he was promoted to the rank of Lieutenant Colonel, Judge Advocate, and served as special counsel to the United States Liquidation Commission in France until April, 1920. He is an officer of the French Legion of Honor and was awarded the American Distinguished Service medal.

He entered the service of The Texas Company in May, 1921, in the legal department. Later he became assistant general counsel and was appointed general counsel in December, 1925. In 1933, he was elected vice president and general counsel, and in 1935 was elected a director. Later in that year he became a member of the executive committee and in 1940 he was made executive vice president and general counsel. He is a member of the American Bar Association and of the bars of the states of Ohio, Kentucky, and New York.

Mr. Saunders was born in Jersey City, New Jersey. His first and only employer has been The Texas Company. In 1909 he took a position as a voucher clerk in the sales department and advanced through several positions to become, in April, 1934, manager of the northern territory. In April, 1935, he was made assistant general sales manager, and in June, 1938, was elected secretary of the company.

Mr. Dorwin, a native of Wisconsin, was graduated from Harvard Law School in 1920. Admitted to practice in Illinois in 1921, he remained in Chicago for five years. In 1926, he became counsel for Indian Refining Company and was

(*Continued on page 46*)

G. Harrison Smith

W. S. S. Rodgers

Harry T. Klein

An historic wedding

A momentous wedding occurred more than 10 years ago when an olefin was joined with a paraffin They are members of two different hydrocarbon families which chemists for years had believed to be wholly incompatible

It was an historic occasion because it was the first step that made possible the development of alkylation processes, especially the U.O.P. hydrogen fluoride alkylation process, supreme today in producing enormous quantities of alkylate, an indispensable component of 100-octane aviation gasoline

The wedding took place in the Universal laboratories when two persevering research chemists discovered that those dissimilar hydrocarbons could be induced to unite, through the mysterious powers of chemicals known as catalysts

This momentous discovery enabled our fighting flyers to win air mastery over the enemy, which today they demonstrate on every front

Such processes helped to turn the tide in this war

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REFORMING	DEHYDROGENATION
HYDROGENATION	POLYMERIZATION
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Petroleum Process Pioneers
For All Refiners

The Refiners Institute of Petroleum Technology

OIL COMPANY STAFF CHANGES

(*Continued from page 44*)
chief attorney for that company when in 1931 its control passed to The Texas Company. In 1933 he was placed in charge of Texaco's legal office in Chicago and remained there until September, 1934, when he was transferred to New York. He was appointed associate general counsel in January, 1942.

J. R. CARRINGER, vice-president of Standard Oil Company of New Jersey, was honored at the semi-annual conference of supervisors and foremen of the New Jersey refineries at the Elks Auditorium on completion of forty years of service with the company.

Mr. Carringer was employed by the company in a tank car repair shop in 1903. In 1921 he was made general superintendent of the Bayway, N. J. refinery. By 1933 he was assistant general manager of all New Jersey refineries of the company and subsequently became general manager of manufacturing operations.

He was elected a director of the company in 1940 and became vice president in 1943.

A. J. JOHNSON, head of the Engineering Department, and Hiram Norcross manager of the New York Office, have been elected vice president of Shell Development Company.

Joining Shell in 1929, Mr. Johnson was first a member of the Norco Refinery laboratory staff and later became assistant department head. In 1936 he was transferred to St. Louis as senior technologist of the development division of the manufacturing department. Moving from St. Louis to Houston, he assumed the position of assistant superintendent of the refinery, where he remained until 1940, at which time he went to San Francisco as head of the engineering department.

Mr. Johnson graduated from Tulane University

Hiram Norcross

in 1929 with a Master's degree. He is a member of the American Chemical Society and Alpha Chi Sigma fraternity.

Mr. Norcross joined Shell Oil Company in 1933 as a member of the legal department in the St. Louis office, later transferring to the company's refining and production division in the midwest. In 1941 he was transferred to the headquarters of Shell Development Company in San Francisco and a year later became manager of the New York office of Shell Development.

EXPANDING research activities and the prospect for the development of new products and new uses for petroleum have led Standard Oil Company of California to organize a separate corporation to deal with this phase of the company's operations. The new subsidiary is the California Research Corporation which has taken over the parent company's patent division as well as its previously established research and development departments.

Officers of the new company are R. G. Follis, chairman; R. A. Halloran, president; J. N. Adams, F. L. Craise, W. N. Davis, Alois Kremser, vice presidents; Ewing Sibbett, secretary; G. M. Foster, assistant secretary; H. D. Armstrong, treasurer.

Ralph A. Halloran, president of the company, has been connected with Standard of California since 1907, one year following his graduation from University of California. For several years he served as a research chemist, later was assigned to the production department and following that was in charge of cracking operations at El Segundo refinery. Since 1926 he has been manager of California Standard's research and development department.

Chairman Follis began his career with Standard as an office boy while attending school in San Francisco. Following his graduation from Princeton in 1924 with a B.S. degree in Physics, he entered the Engineering Department at the Richmond Refinery. During the next two years he worked as fireman of the crude stills in the operating department and as a helper at the Bakersfield Refinery. He became Assistant Superintendent at Bakersfield in 1926 and two years later moved on to the Superintendency of the Paso-Tex Refinery in El Paso. In 1932 he returned to the home office in San Francisco as a member of the manufacturing department and became general manager of that department January 1, 1940. He was elected to the Board of Directors in 1942 and became a vice-president at the end of that year.

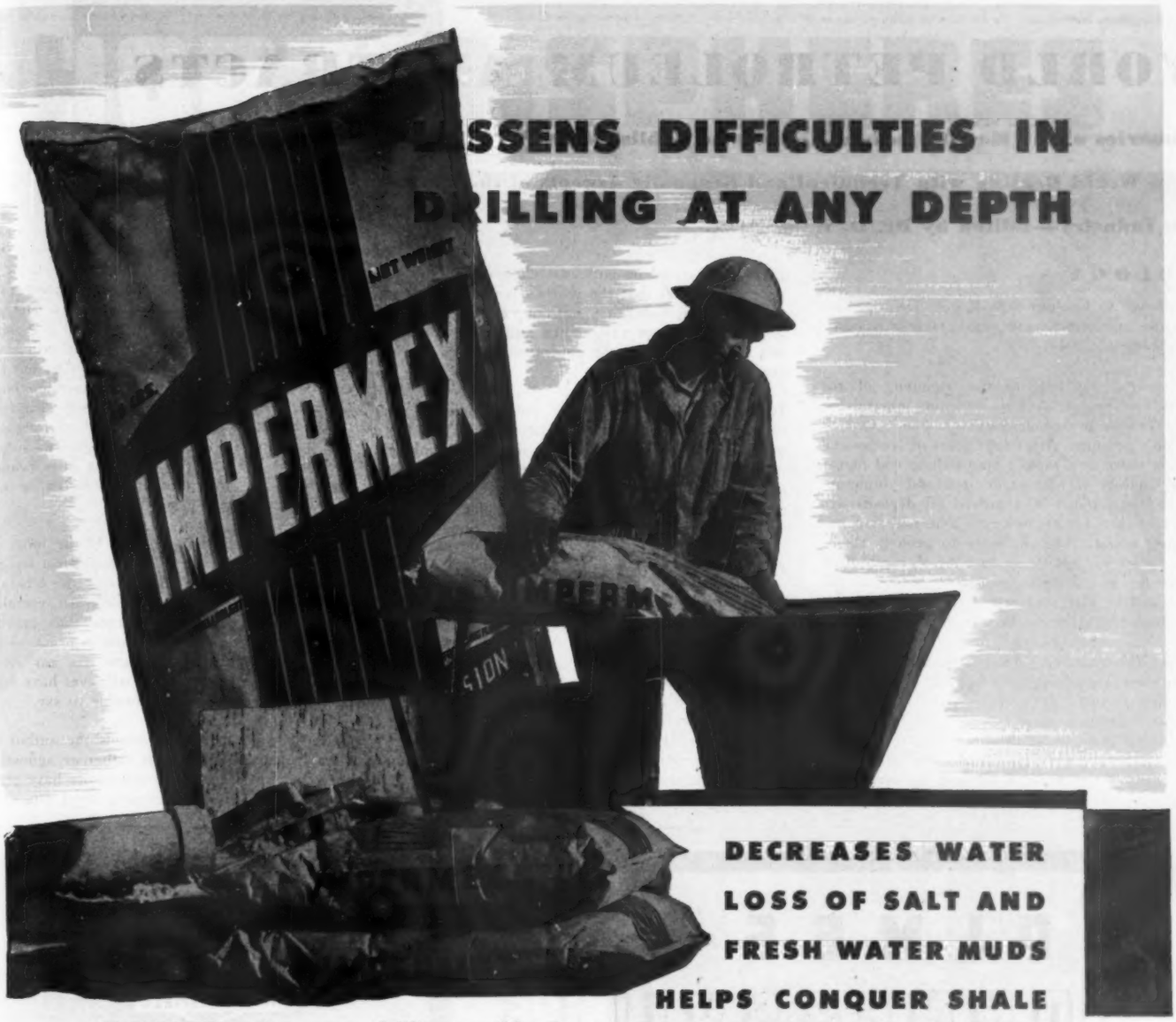
At the present time Mr. Follis is chairman of the Aviation Gasoline Sub-committee of PAW in District 5, a member of the District Refining Committee and of the PAW Foreign Refining Committee. He serves also on the directorate of several Standard subsidiaries and affiliated companies.

(*Continued on page 66*)

A. J. Johnson

R. A. Halloran

R. G. Follis



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DECREASES WATER LOSS OF SALT AND FRESH WATER MUDS HELPS CONQUER SHALE AND OTHER CAVING FORMATIONS — LOWERS WATER LOSS TO OIL SANDS

IMPERMEX solves many drilling troubles in both deep and shallow wells. It greatly decreases the water loss of drilling muds, whether fresh water or contaminated with salt or salt water, and assures a thin filter cake in either case. IMPERMEX mud is advantageous when drilling into oil sands, as the permeability is not impaired by the intrusion of water.

Shale and other caving formations give less trouble with IMPERMEX and BAROID in the mud because this combination provides very low water loss with whatever weight is required.

IMPERMEX is easily added directly to the mud. Lessened drilling difficulties make it economical to use.

Patent Licenses, unrestricted as to sources of supply of materials, but on royalty bases, will be granted to responsible oil companies and operators to practice inventions of any and / or all of United States Patents Numbers 1,807,082; 1,991,637; 2,041,086; 2,044,758; 2,064,936; 2,094,316; 2,119,829; 2,214,366; 2,294,877; 2,304,256 and further improvements thereof. Applications for Licenses should be made to Los Angeles office.

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WORLD PETROLEUM ABSTRACTS

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing with Technical and Economic Aspects of the Petroleum Industry—Edited by Dr. O. W. Willcox.

GEOLOGY

A Challenge to Geology—A Roger Denison, before AMERICAN ASSOCIATION PETROLEUM GEOLOGISTS, Dallas Meeting, 1944.

It is pointed out that at the beginning of the current war deposits of all common minerals in North America were adequate for many years of peace-time pursuits. After four years of accelerated war use, there is a rapidly approaching end to the known deposits of high-grade iron and aluminum ores, and our known and proved oil deposits are being used at a far greater rate than new supplies are being found. The challenge to geology therefore is: Can its application to mineral exploration discover the new deposits needed to supply the deficit created by war, and provide an ample reserve for unhampered progress in peacetime?

To meet this challenge American geologists must add to their knowledge and application of every aid to prospecting. It is imperative to find new techniques and apply them to new areas and to old areas where previous study has failed to indicate favorable conditions. Heretofore, the geologists' search for oil has been dominated by structural thinking; his work has been largely devoted to finding a trap sealed by anticlinal closure, and this in spite of the fact that the world's largest and most productive oil fields are not anticlinal accumulations. In fact, one well known authority says that less than one-half of the known oil deposits are in true structural traps.

It is, therefore, necessary for the geologist to increase his knowledge of the relation of oil deposits to sedimentation, so that he may direct his thinking toward the finding of oil where there is little positive structural evidence, but where sedimentation, stratigraphic sequence, and a suitable reservoir rock combine to form a trap for petroleum.

GEOPHYSICS

Geophysics Looks Forward—R. D. Wyckoff, before SOCIETY EXPLORATION GEOPHYSICISTS, Dallas, 1944.

In this presidential address the author undertakes to dispel some illusions, one of which is that new geophysical methods will come out of the war. In fact, he does not see any new geophysical tool anywhere on the horizon. As to how much further improvement is to be expected in existing reconnaisance tools, it is noted that we have practical gravimeters, but they have already reached the point where accuracy of observation exceeds the "noise level", and hence there is no justification in striving for increased instrumental sensitivity. With modern interpretation technique applied to field data of sufficient detail and accuracy the magnetometer has a definite usefulness, and it is said that improvements in magnetic instrumentation are in sight that will enhance its capabilities, but it will represent an improved reconnaisance method and not a radically new oil finding tool. Electromagnetic methods, including electrical prospecting methods, may or may not show greater success in the future than in the past, but it is confidently asserted that radio frequency will not be applied to oil-finding.

To date, electric wave energy is the most useful method of probing the subsurface. In a sense, it is a more direct method than any of the others mentioned, but its records include such complexities introduced by intervening strata that precise interpretations are impossible, and in practical operations only a part of the data has any meaning. Whether these latent details will ever have diagnostic significance it is yet impossible to say.

Concerning geochemical methods the author is not a confirmed disbeliever, but rather an agnostic who feels that several years of experience have provided no conclusive answer regarding their effectiveness.

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These machines deliver a positive, reliable and oil-free supply of air economically and efficiently. Absence of internal contact ensures long life, low maintenance costs and continuous operation over long periods.
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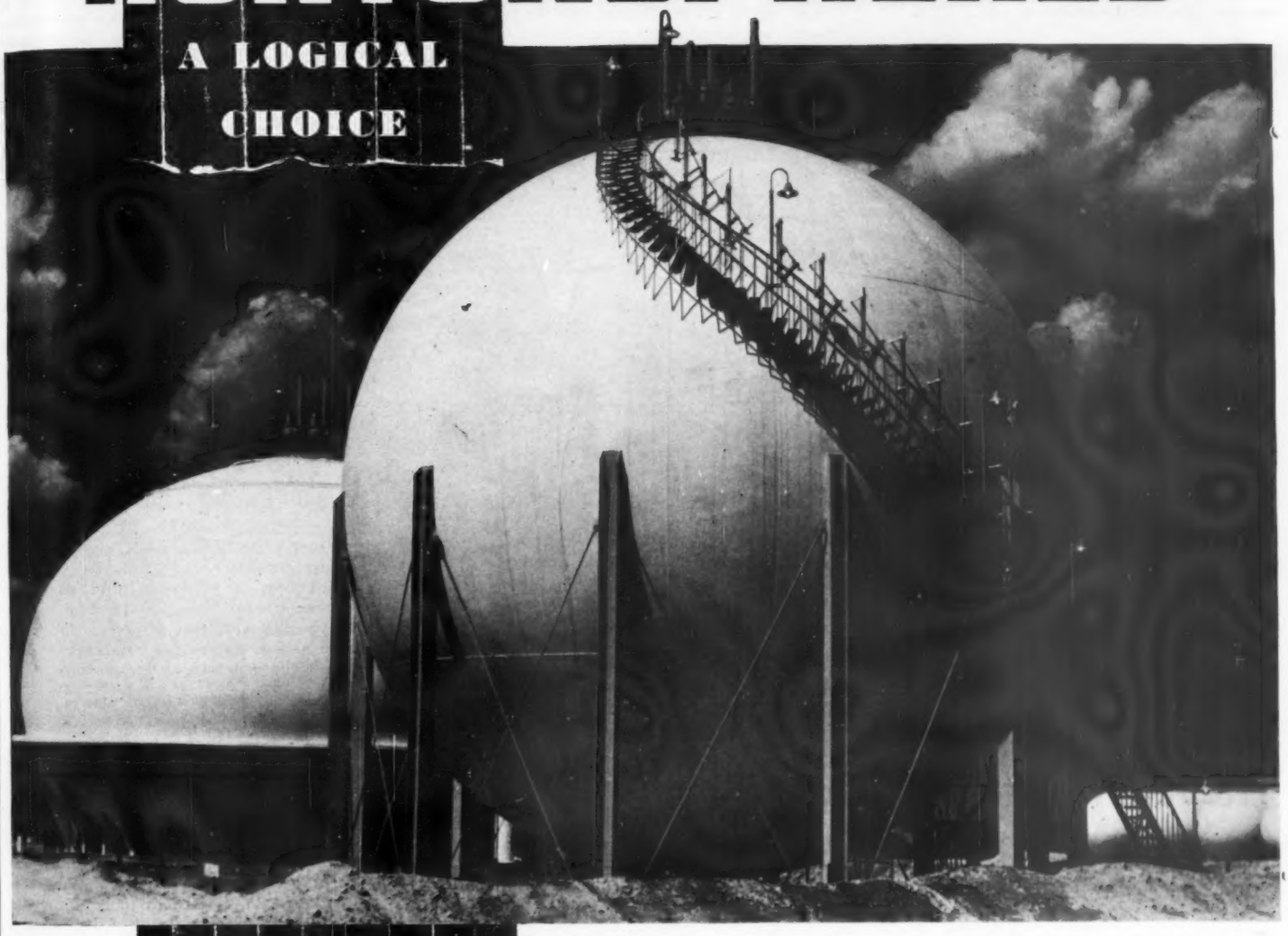
HORTONSPHERES

A LOGICAL CHOICE



. . . FOR THE STORAGE OF Butadiene

The Hortonsphere shown above is used for the storage of butadiene. It is located at the "Plains-Plant" which is owned by the Defense Plant Corporation and leased to the Phillips Petroleum Co. who operate it for the Rubber Reserve Company.

IN THE PRODUCTION of synthetic rubber from petroleum, one of the important steps involves the storing and handling of butadiene. This essential material, in its highly purified state, must be handled and stored under pressure to prevent excessive loss by evaporation. Hortonspheres are the logical choice for this type of storage because they are designed to withstand pressures built up in the vapor space at normal temperatures without venting. These vapor-tight, spherical pressure vessels not only stop evaporation but also protect the inherent quality of the product stored.

Hortonspheres are widely used for handling of many volatile liquids and gases. They are built in capacities of 1,000 to 20,000 bbls. for pressures from 20 to 100 lbs. per sq. in.

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TULSA — WASHINGTON

Without further enlarging on the subject, he expresses a firm conviction that the effectiveness of geophysical exploration can be substantially increased by application of more judicious handling of equipment, of the data, obtained, and of the available geophysical talent.

In conclusion, while acknowledging that geophysical interpretation has its risks, it is suggested that if the oil industry insists that the geophysicist find not only structural but also stratigraphic traps and thus at least halt the accelerating declining rate of discovery, the oil company managers must accept and act upon seismographic data far less certain in character than has been acceptable in the past. A geophysicist is required to be imaginative and venturesome. The current administration of geophysics should encourage rather than suppress such traits, and be more willing to give the geophysicist more ready access to the policy making and action formulating sanctums of the industry.

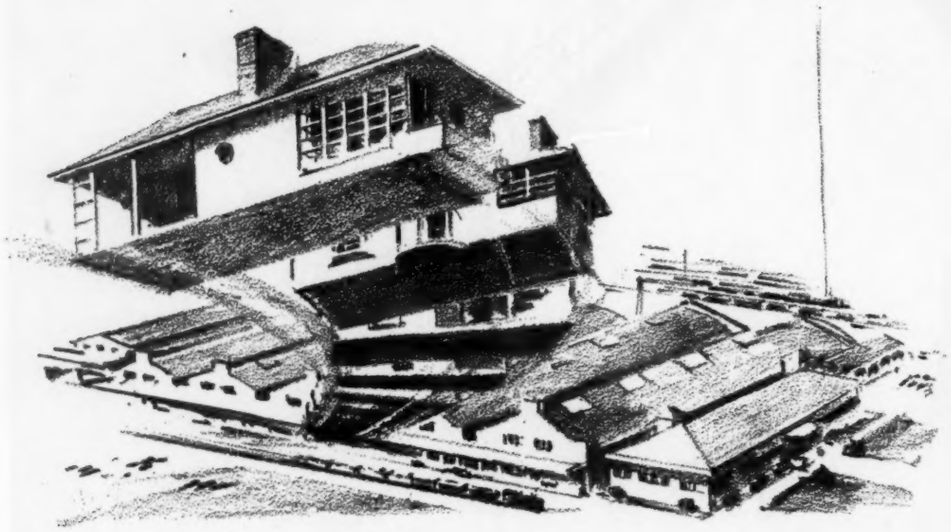
OPERATION

Artificial Flooding in Illinois— Frederick Squires and Alfred H. Bell, in Illinois State Geological Survey Report of Investigations No. 89.

This publication summarizes the history of oil-field flooding in Illinois, both accidental and purposeful. Some of the accidental floods that were due to the intrusion of water from lower or upper horizons produced more oil than was originally present in the sand, and there have been cases where production after flooding reached and even surpassed the peak heights of the original flush production. Seven artificial floods have been undertaken at various times.

As regards the probable success or failure of applied floods on other Illinois sands, the argument has been raised that natural floods move under their own power and that the only areas available for purposeful flooding are sands now depleted of all reservoir fluid movement. But all sand and lime oil-producing strata in Illinois are under some edgewater pressure, and edgewater encroachment differs from applied flooding only in speed. Given time enough, all Illinois producing sands would experience edgewater encroachment. The lessons to be learned from natural floods are, first, that water moves oil, and secondly, that many Illinois sands are continuously permeable over large areas; thirdly, when a natural flood at Sandoval was supplemented by an artificial flood introduced within it, this applied flood further increased production. It was proved that each kind of flood produced the same kind of result in increasing oil production.

The efficiency of accidental floods which occur in sands under edgewater drive is further evidence that applied floods would be successful in edgewater encroachment territory. Because of these facts it is logical to recommend that purposeful flooding in advance of natural water drive be applied in pools that are already under edgewater pressure.



The Answer to Low-Cost Homes in 194X
The *Prefabricated* House

The prefabricated house is the logical answer to the public demand for a livable, low-cost home to fit the wage earner's pocketbook. It will bring the economies of mass production to the housing field, and will open up new sales possibilities and profits for the retail lumber and other established retail dealers.

Our planning department is still at work seeking an ideal house plan for adaptation to the economies of prefabrication. Just when the unknown X can be replaced by a definite year, no one knows, but when that time arrives, we will have a sound, livable prefabricated house available than can be merchandised with profit, whether in 1944, 1945 or later.

At present, as for the past two years or more, our entire manufacturing facilities are engaged in producing war materials for our Government, applying the "know-how" gained since 1917 to the prefabrication of war materials. If your name isn't on file to receive our portfolio and package plan for dealers as soon as it is released, write us now, so you'll have these facts when they are available.

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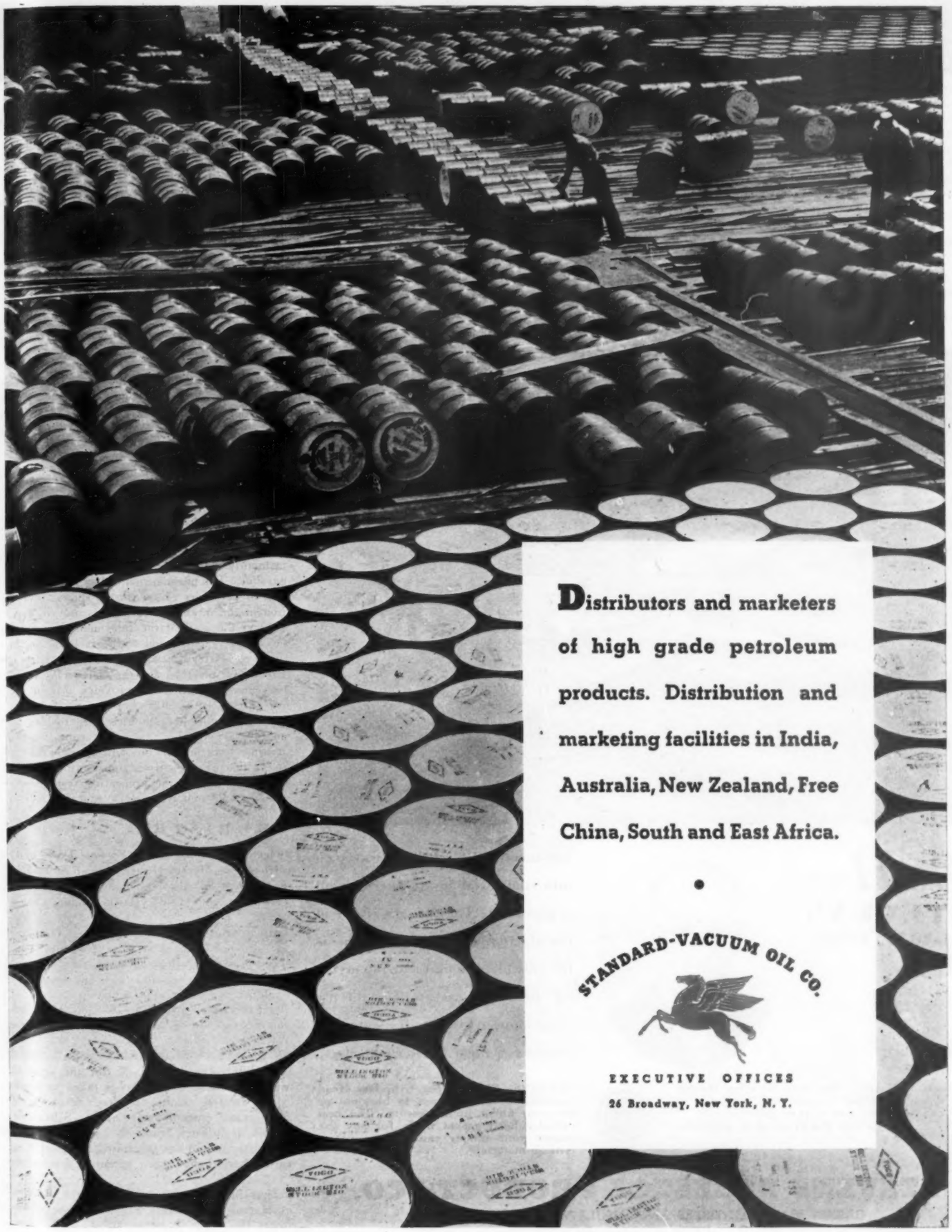
NATURAL GAS

Storing Natural Gas to Relieve Peak Demands— J. French Robinson, in OIL AND GAS JOURNAL, vol. 42 (1944) No. 43, pp. 56, 59-60.

The author notes a rapid increase in the practice of storing natural gas under pressure in depleted or partly depleted sand formations to be withdrawn later to meet peak demands. As of December 1, 1943, the underground gas storage capacity of the areas in the United States now in use for that purpose was 135,000,000,000 cubic feet with a delivering capacity of 750,000,000 cu. ft. a day. Altogether, there are to be found fifty or more natural-gas-storage areas in the United States and Canada. Many of them are in the Appalachian area, which is close to the great consuming centers and where there is a shortage of supplies. The Appalachian gas fields are being rapidly depleted and this fact, together with the rapid extension of long-distance pipe lines have stimulated the development of underground storage.

The author provides some comparative figures on the cost of storing gas by this and the three other methods used for the purpose. The cost of constructing low pressure gas holders is about $80,000 per million cu. ft. capacity, which is prohibitive for large installations. Compression in closed steel containers at 5 to 30 lbs. pressure costs about $200,000 per million cu. ft. of storage capacity.

The method of liquifying gas and storing it in liquid form has been recently developed and has been found to be highly successful. The plant of this type owned and operated by the East Ohio Gas Co. was built at a cost of $7,100 per million cu. ft. of storage.



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This company also has underground storage in the Chippewa area. This pool, which is completely controlled by stratigraphic trapping, covers about 6,000 acres, has 18 active wells and a 1020 H.P. compressor station. Storage began in 1941 with a rock-pressure of 416 lbs. which was later built up to 1,000 lbs; at this pressure the total amount of gas in storage is 6 billion cu. ft., including 3,250 million cu. ft. of original reserves. To raise or lower the rock-pressure 1 lb., 17,300,000 cu. ft. of gas has to be withdrawn or forced into the storage area. The cost of the project, including the gas in reserve at the time storage was begun, was $1,000,000.

While this method of gas storage is by far the cheapest, the other three methods have their peculiar and particular places in the operation of gas properties.

Combustible Gases as Substitute Motor Fuel—Gustav Egloff and Mary Alexander, before AMERICAN CHEMICAL SOCIETY, Cleveland Meeting, April 1944.

Combustible gases have replaced over 3,000,000 barrels of gasoline in the operation of about 140,000 motor vehicles in Europe, since these gases come from domestic sources. Even in the United States propane and butanes are used in about 25,000 vehicles. Methane, ethane, propane, and the butanes are obtained from oil and natural gas wells, refineries, coal mining and processing, sewage, and city gases. Acetylene, ammonia, and hydrogen are used in countries particularly where there is abundant water power to furnish electric energy. Utilization of all these fuels has been limited in Europe since high-pressure equipment requires materials of which there is a shortage. Although at present the equipment is much heavier, the fire hazard greater, and commercial distribution poorer than with gasoline, gases may play an important role in the future of motor transport.

USES

Oxidation of Fuels in the Intake System of the Engine—B. A. Kravets and A. S. Sokolik, in Reports Russian Academy of Science, Technological Division, 1942, Nos. 3-4, pp. 27-32.

It was found by experiment that when cracked gasoline was introduced into an engine at 150° C. and 1200 revolutions per minute the octane number was measured as 60, whereas when the same cracked gasoline was fed to the engine at 65° C. the effective octane number was 72; when the same engine was run under the same conditions with straight run gasoline the drop in octane number was only from 69 to 68.

The investigation led to the conclusion that this drop in octane number is due to the anti-knock instability of the Olefin constituents of the cracked gasoline. The phenomenon is ascribed to the formation of peroxides. Experiments showed that oxidation in the intake system occurs only in the liquid film on the wall of the tube under a condition of incomplete vaporization of the fuel, and in the case when the latter contains unsaturated hydrocarbons. Preheating the tube and the air to 170° completely prevented formation of peroxides. When the tube was preheated to 100° but the air was not preheated, considerable amounts of peroxides formed, and these peroxides are sufficient to cause a substantial lowering of the anti-knock value of the fuel. To mitigate this circumstance it appears advisable to modify the preheating systems so as to permit rapid and complete evaporation.

CHEMISTRY

Selectivity of Solvents for Various Types of Hydrocarbons as Measured by Critical Solution Temperature—Alfred W. Francis, before AMERICAN CHEMICAL SOCIETY, Cleveland Meeting, April 1944.

Critical solution temperatures have been determined for over one hundred solvents of various types with ten representative hydrocarbons, two straight-chain paraffins, a branched-chain paraffin, two olefins, two naphthenes, paraffin wax, and two commercial oils. Aromatic hydrocarbons are too miscible with these solvents to observe the critical solution temperature.

The differences in C. S. T. for the same solvent with different hydrocarbons is taken as a measure of the relative affinity or selectivity of the solvent for the two types of hydrocarbon. Selectivities for olefins, naphthenes, branched chains, type of oil, and molecular weight are calculated and plotted against each other to show their extent of interrelation.

Effects of substituent groups in the solvents are estimated. The methyl and phenyl groups usually lower the C. S. T. about 40° C. The nitro and carboxyl groups raise it over 100° C.

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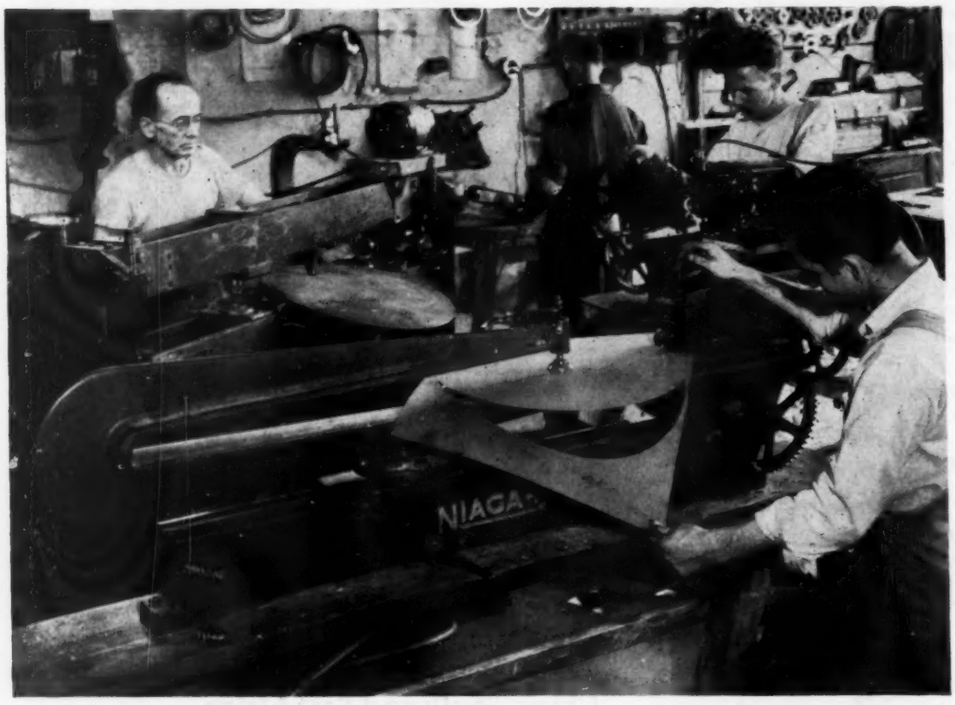

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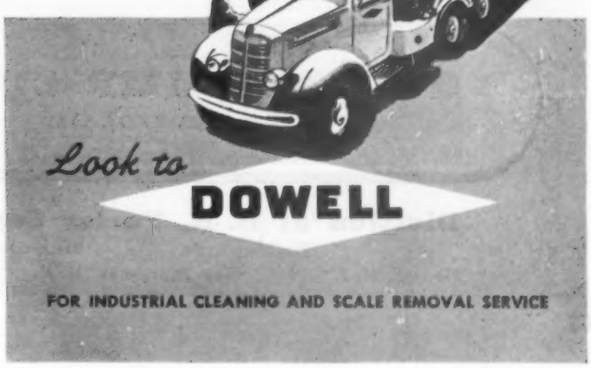

REFINING

Glass Fibers as Packing for Distilling Columns—Geo. W. Minard, Joseph H. Koffalt and James R. Withrow, in TRANSACTIONS AMERICAN INSTITUTE CHEMICAL ENGINEERS, Vol. 39 (1943), pp. 813-857.

Due to the fact that existing alcohol distillation units have been taxed to the utmost by war demands and inability to procure materials and skilled manpower to construct new plate columns, some industrial alcohol plants have built columns with glass fibers as the packing materials.

(According to a statement issued by the Owens-Corning Fiber Glass Corporation, the columns at the Bardstown, (Ky.) plant of Hiram Walker & Sons are 43 feet and ⅞ inches high with inside diameter of 50 inches. There are four packed sections in each column, each 7 feet high. The glass fibers average 20 inches in length and 0.0085 inch in diameter, and are packed in these sections at a density of 3.7 lbs. per cu. ft. Rate of feed to the columns is 11,200 gals. per hour and the amount of product taken per hour is 4,700 gallons. The reflux amounts to 2,300-2,400 gallons per hour and the velocity of vapor in the columns is 5 feet 6 inches per second. The alcohol obtained is from 190.0 to 191.4 proof, with the greater part of the production near the higher proof.)

To obtain precise data on the chemical engineering characteristics of this material the authors of this paper constructed and operated two laboratory columns packed with glass fibers at a density of about 4 lbs. per cu. ft. Runs were made on the systems ethanol-water and methanol-water at vapor velocities of 0.80 to 5 ft. per second. Within the ranges investigated rate of throughput had no appreciable effect on the performance characteristics of the packing. Pressure drops were exceedingly low at vapor velocities as high as 5 feet per second, and it appears that higher rates of throughput might be obtained.

The conclusion is that glass fiber packing appears to possess all the characteristics of a satisfactory material for packed column distillation work, including good rectifying performance, high rate of throughput with low pressure drop, consistent behavior under long use, light weight per unit volume, and low cost.

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BOOK

Radioactivity Well Logging—Published by Lane-Wells Company, Los Angeles; 52 pages 8½ x 11; Gratis.

This brochure is worth noting as it is apparently the most complete work published to date covering the actual field experience with radioactive logging. Numerous case histories from the Gulf Coast, Mid-Continent and California areas are presented and discussed. These cases have involved the application of radioactive logging to problems presented by new wells, old wells, workovers and deepening jobs, the location of porous streaks, location of water entry, elimination of undesirable zones in water wells, repair work, plugback procedure, differentiation of sands and limestones, etc. Typical curves and sections are reproduced from nearly all the principal oil areas in the United States. Many of the radioactivity logs are shown together with the electrical logs of the same wells.

An introduction is provided for an explanation of the nature of radioactivity, the natures of the gamma rays and neutron curves, and the apparatus used for the application of radioactivity well logging to the problems of the petroleum industry.

Lummus Petroleum Refining Processes

Aside from an outline of the engineering services which The Lummus Company has long been rendering to the petroleum refining industry this large brochure of 54 pages is notable for a collection of instructive flow diagrams of the various refinery processes which Lummus has built and brought to successful commercial operation. These diagrams illustrate:

Thermafor catalytic cracking process, Houdry catalytic cracking process, Lummus naphtha polyform or gas reversion unit, Lummus naphtha-gas oil polyform unit, Lummus combination cracking unit, Lummus delayed cooking unit, Lummus viscosity breaker unit, Lummus two-stage distillation unit, Lummus three-stage distillation unit, complete lube oil processing system, Lummus carrier distillation unit, propane deasphalting process, furfural refining process, solvent dewaxing process, Lummus lube oil rerun unit, Lummus special naphtha rerun unit, Lummus superfractionation unit, Pure oil thermal polymerization process, Perco catalytic desulfurization process, tannin solutizer sweetening process. Photographic illustrations of many of the completed installations are shown.

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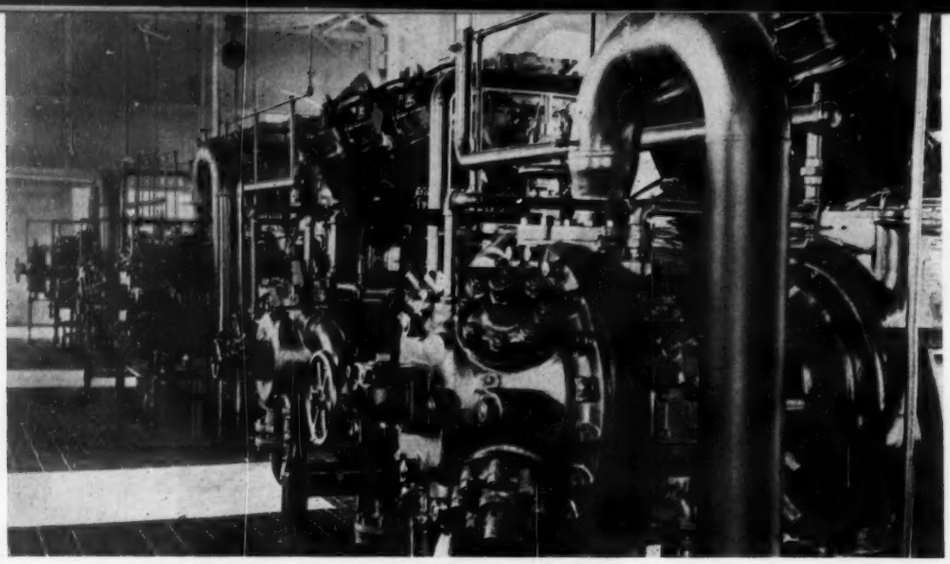


Three Compressors Handle 4,280,000 ft. of Gas Daily.

GAS INJECTION IN WYOMING FIELD

Gas injection resulted in the recovery of an additional 1,623,237 barrels of oil at the Wertz-Dome field of Sinclair Wyoming Oil Co., during the past two and one-half years, it is disclosed by records covering that period of operation.

In order to help meet current war needs, pressure maintenance operations at the Wertz-Dome field have been designed so that a volumetric balance is maintained between the oil withdrawn and the gas injected so that it will be possible to realize maximum oil recovery and deplete the reservoir in much less time than would ordinarily be required.

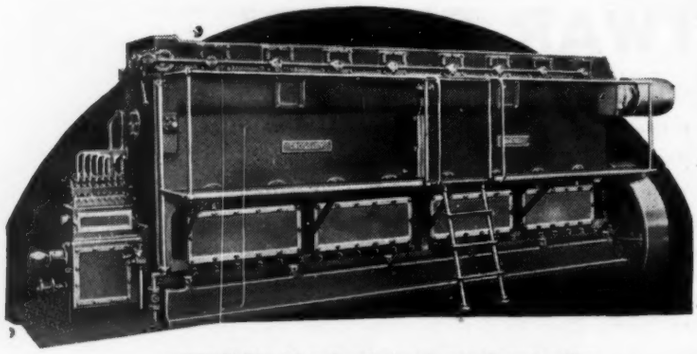
After a thorough study of the reservoir conditions it was calculated that 1,400 cubic feet of gas would be required to displace a barrel of oil. Thus, by returning to the deposit this volume of gas for each barrel of oil over the normal daily output of 3,300 barrels, recovery could theoretically be sustained at any rate desired without decline of pressure, and, by returning a greater volume of gas, the output could be increased.

Gas is injected to the formation through tubing by means of three gas-fueled Cooper-Bessemer compressor units totalling 1,800 horsepower. Of the two-cycle, angle type, these six cylinder engines have a rated capacity of 2,000,000 cubic feet daily with a discharge pressure of 2,500 pounds.

To obtain the present high rate of oil production 4,280,000 cubic feet of gas is pumped daily to the pools at a discharge pressure of 1,825 pounds per square inch.

Pressure maintenance operations of this kind, if put into practice at all fields where practicable, would materially increase the volume of oil available to meet the emergencies of war and at the same time would help to relieve tightening restrictions on petroleum products for civilian and commercial use.

Such a program would be in direct accordance with the plea recently made by D. R. Knowlton, Director of Production for the War Petroleum Administration, who said "We must not only do everything possible to maintain domestic production from known fields, but also augment it by further adoption of secondary recovery and pressure maintenance projects wherever possible."



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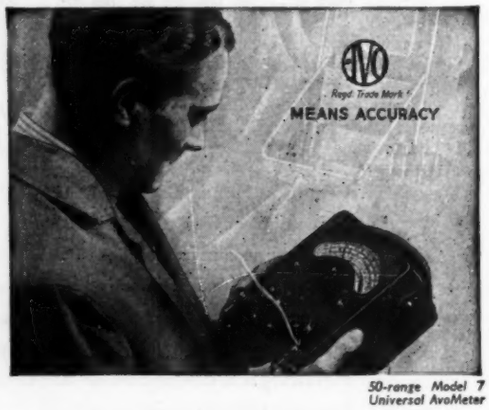

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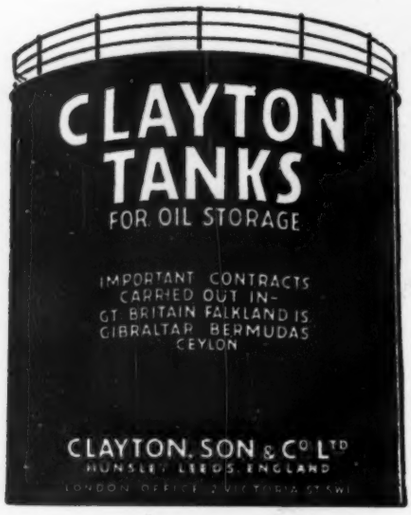

OIL COMPANY STAFF CHANGES

L. E. Fitzjarrald

A NUMBER of changes have been made in the personnel of the Production Department of Phillips Petroleum Company. H. H. Kaveler, formerly technical advisor, is now assistant to vice president C. P. Dimit. L. E. Fitzjarrald has been appointed general superintendent. J. M. Houchim, formerly district superintendent at Russell, Kansas, has been made assistant general superintendent with headquarters in Bartlesville. P. C. Murphy and J. S. Montgomery have been made regional superintendents. R. D. Sterling is superintendent of the Hugoton District and Ralph McKnight, formerly field foreman at Oklahoma City, is now district superintendent at Russell, Kansas.

FREDERICK JOHN TWOGOOD, for many years general manager of the Standard-Vacuum Oil Co., at Shanghai, China, died April 28th in Rochester, Minn., at the age of 54.

Shortly after December 7, 1941, Mr. Twogood was imprisoned by the Japanese in the Bridge

(*Continued from page 46*)
House jail in Shanghai, where he spent 109 days of incredible hardship and privation. He was repatriated on the S.S. Gripsholm in August, 1942.

Mr. Twogood was born in Raynertown, N. Y. He was graduated from Colgate University in 1912. Upon graduation, he was employed by the Standard Oil Company of New York in China, where he spent over 30 years. He retired from the active service of Standard-Vacuum Oil Company last year.

TIDE WATER ASSOCIATED OIL COMPANY has announced the appointment of Drew L. Hines as manager of transportation and supplies, eastern division, with headquarters in New York City. Hines succeeds former vice president George J. Hanks who has resigned.

An employee of the western division of Tide Water Associated for more than 21 years, Hines has had wide experience in the oil business, particularly in engineering, constructions and transportation operations. For the past 3 years he occupied the position of assistant manager of transportation, western division with headquarters in San Francisco.

WILLIAM P. HEADDEN has been appointed assistant manager of the Sales Engineering Department of the Standard Oil Company of New Jersey. Since 1943, he has been supervisor of the fuels and lubricants section.

A graduate of Rensselaer Polytechnic Institute in 1929, Mr. Headden joined the Standard Oil Company at Bayway, N. J. as a student engineer. In 1937 he was promoted to assistant supervisor of the fuels and lubricants sections. Since the outbreak of war he has been devoting much of his time to the solution of lubrication and fuels problems of war industries.

William P. Headden

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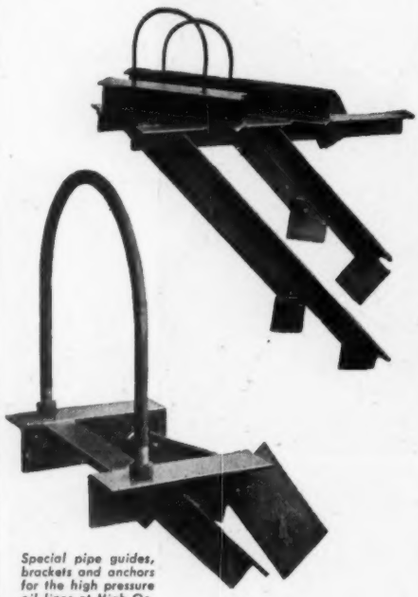

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GALLAGHER ON OIL POLICY

WRITING in the annual report of Standard Oil Company (N. J.) President Ralph W. Gallagher sets forth his views and those of his company on world oil policy in the following terms:

"If, after this war, any substantial part of the world is to enjoy a standard of living approaching that achieved in the United States, world production of oil must be greatly increased. World production of goods sufficient to provide such a standard of living will require vast quantities of oil for machines, power and transportation.

"There are, we think, two principal problems. One is to find more oil. The other is to establish sound, world-wide, conservation policies under law so that oil will not be taken from the ground wastefully.

"It is our view that government is properly concerned with conservation policy and that an international oil conservation agreement is desirable. In the United States similar problems of conservation and efficient use in the general interest have been met by the various producing States acting through the Interstate Oil Compact under the coordinating authority of the Federal Government. Competition between individual companies remains vigorous.

"It is our view that new oil resources are most apt to be found by free, enthusiastic, enterprising men. Governments have not only been unsuccessful in finding new resources but when competing with private companies have actually prevented the discovery of new resources.

"We believe that the United States should take the initiative, in collaboration with other oil producing nations and eventually with all interested nations, in seeking an international oil conservation agreement. We believe further that the United States government should encourage American private enterprise, first by refraining from competing with private individuals and companies, and second by lending American enterprise diplomatic support where Americans are at a disadvantage in foreign countries by reason of foreign laws or practices."

Ralph W. Gallagher

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